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AN INVESTIGATION OF THE EFFECT OF COORDINATIVE ABILITY TRAINING PROGRAM ON ATTENTION, VERTICAL JUMP, AGILITY AND REACTION TIME PERFORMANCE OF U-12 TENNIS PLAYERS

Research article

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Abstract

The aim of this study was to investigate the effects of coordinative ability training combined with basic tennis training on attention, vertical jump, agility and reaction time of tennis players. A total of 24 tennis players (10 girls-14 boys; aged, 11±0.89 sport age, 2.25±0.85 height, 156.08±7.06 cm and weight 42.92±6.15 kg.) voluntarily participated in the study. The tennis players were divided into two groups as experimental and control groups by random sampling method. The experimental group participated in coordinative ability training with basic tennis training for 12 weeks, while the control group only participated in basic tennis training. As a result, a statistically significant difference was found in the vertical jump, agility and attention values of the experimental group, while no significant difference was found in reaction time ($p>0.05$). As a result, it can be said that coordinative ability training has an effect on jumping, agility and attention.

Keywords: Tennis, motoric parameters, coordinative ability training

1. Introduction

Tennis is a performance sport that involves aerobic and anaerobic loads together and also requires a good level of factors such as reaction, strength, speed, endurance, attention, agility, balance, flexibility and coordination (Bashir et al., 2019; Fernandez et al., 2013). In addition, instant thinking and decision-making, attention and agility parameters should be at the highest level (Çağın&Çetin, 2022). The athlete, who will respond to the tennis ball coming in a very short time, should collect his/her instant attention and decide where to throw the ball within this time (Salonikidis & Zafeiridis, 2008). It is extremely important for the tennis player to have the highest level of attention and agility in order to make effective and targeted strokes. Especially during the competition, the athlete must select, perceive, decide, prepare, and then execute the correct movement within a minimum time frame from among all the stimuli (Kovacs, 2009). Reaction time, first-step quickness, lateral (side steps), and forward speed over short distances are crucial parameters for tennis performance (Miranda et al., 2020). The ability of a tennis player to quickly react is crucial to successfully answer the incoming balls from a serve or a passing shot (Parsons & Jones, 1998). Due to the nature of the game, tennis allows players to quickly transition to different positions one after the other at unexpected times with instantaneous zone and position changes. The success of a tennis player can be related to the success of the athlete when he/she sees which direction the tennis ball, which gains momentum during the transition, is heading to that area quickly. Considering that a tennis player needs to

perform the movement in a fraction of a second, the importance of agility, attention and reaction emerges (Veale et al., 2010; Sheppard & Young, 2006; Unierzyski, 2002; Salonikidis & Zafeiridis, 2008).

When the studies on coordinative ability exercises are examined, both the effect on motoric parameters and the effect on cognitive performance are noteworthy. For example, several studies, which focused on the association between physical exercise and cognitive function during adolescence, have documented a positive relationship between physical fitness and academic achievement (Shephard et al., 1994; Shephard, 1997; Donnelly & Lambourne, 2011). In another study, it was reported that coordinative ability exercises applied with a standard physical education program had an effect on motoric parameters and cognition. It is also stated that these trainings affect the speed and accuracy of attention tasks. Besides, it is emphasized that complex motor tasks are effective in terms of faster decision making, concentration and making the most appropriate move (Planinsec, 2002). It is undoubtedly very important to know the relevant stimuli and to be able to respond to these stimuli in a timely manner. Therefore, the reaction time of the athlete whose reaction time improves will also increase the ability to accelerate, stop and change direction, and agility performance will improve (Verstegen & Marcello, 2001). Athletes who exhibit a high level of agility will often have qualities such as visual processing, attention, rhythm and dynamic balance (Ellis et al., 2000). In tennis, athletes with high agility parameters are considered to have an advantage over the opponent (Fisch, 2000). In their study on tennis players, Salonikidis and Zafeiridis reported that the reaction training program applied outside of tennis training had a positive effect on reaction time by decreasing it and that this change was seen both in the training model in which only tennis drills were used and in the combined training model (Salonikidis & Zafeiridis, 2008). Particularly in tennis, reaction time, first step quickness, speed over short distances, rapid change of direction and lateral movement are important determinants of performance. In fact, tennis players spend 48% of their time moving laterally. Therefore, it has been emphasized that linear and lateral reaction exercises practiced 2-3 times a week for 15-20 minutes are effective on the player's reaction and agility (Parsons & Jones, 1998). It is stated that a tennis player's lack of quick reaction, movement or agility should be seriously considered in training programs and corrected if possible (Roetert & Ellenbecker, 2007). It is thought that the implementation of programs that include coordinative ability with training or exercise in adolescents may affect attention, reaction and consequently agility parameters. There are studies that coordinative ability training applied in addition to basic training provides advantages in terms of both development and performance, especially during adolescence (Donnelly et al., 1998, Zach & Shalom, 2016. Alesi et al., 2016). Given all these factors, it is considered that coordinative ability training together with basic tennis training can be effective especially in terms of the performance of tennis players at the lower level.

2. Method

2.1. Subjects

The study was conducted on 24 tennis players (10 girls-14 boys) aged 11±0.89 sport age, 2.25±0.85 years, height, 156.08±7.06 cm and weight, 42.92±6.15 kg. The tennis players were divided into two groups as experimental and control groups by random sampling method. Participants were informed about the nature of the study and were also informed that participation was voluntary and that they could withdraw at any time. Participants were included in the study if they had been licensed for at least 1 year, trained regularly 3 days a week, and had not had any sports injury in the last 6 months.

Table 1. *Characteristics of Subjects*

	n	Min.	Max.	$\bar{X}$	S
Body Height (cm)	24	146	172	156,08	7,06
Body Weight (kg)	24	34	53	42,92	6,15
Age (Year)	24	10	12	11,00	0,89
Sport Age (Year)	24	1	4	2,25	0,85

2.2. Study Design

The study was conducted in accordance with the Declaration of Helsinki and approved by the Ethics Committee of the Gazi University (Code:17/08). Participants were divided into two groups as experimental (n=12) and control group (n=12). For 12 weeks, the control group only practiced tennis training three days a week, while the experimental group practiced 20 minutes of coordinative ability training (Latino et al., 2021) along with tennis training. The subjects underwent height/body weight measurement, attention, reaction, vertical jump and agility tests as pre and post-test. The basic tennis training program and coordinative ability training program to be applied in the study were prepared together with the national team coach. Basic tennis training program (technical, tactical, athletic performance studies (8-10 min warm-up, 50-55 min main part and 8-10 min cool down) hand ball work, throwing ball with racket, coach volley study, rally and game studies were performed.

Table 2. *Basic Tennis Training Programme*

Day	Warm-up Exercises	Main Section	Cooling-down Exercises
Monday Wednesday Saturday	8-10 min On-court warm-up exercises Ball Carrying Game - 3 laps around the court jog run - Foot exercises - Foot exercises between Double-Single line - Stair exercises - Slalom - Hop Jumping - Static and Dynamic Stretching Exercises	(Technical-Tactical Training) Hand Ball Feeding (FH-BH) Target Exercises Racket Ball Feeding (FH-BH-Volley-Dunk) Target Ball Throwing Practice Technical-Tactical Targeted Practice with Coach Volede Player 2 Player Practice for Technical-Tactical Purpose in Rally Score Play Service-Return targeted design (Athletic Performance Exercises) Rhythm and Coordination Exercises Jumping Exercises Attention and Concentration Agility Drills Speed Drills Endurance Exercises Strength training Linear and lateral exercises	8-10 min Cool down exercises practiced in the court - Mild tempo cool-down jog Jog - Static and Dynamic Stretching exercises

Table 3. *Coordinative Ability Training Programme*

Week	Day	Warm-up Exercises	Main Section	Cooling-down Exercises
1-4. Week	Monday Wednesday Saturday	8-10 min On-court warm-up exercises Ball Carrying Game - 3 laps around the court jog run - Foot exercises - Foot exercises between Double-Single line - Staircase exercises - Slalom - Hop Jumping - Static and Dynamic Stretching Exercises	- Touching body parts with audible stimuli (3x3) - Audible stimulus lying lying forward and backward and touching 3 different colored balls on the floor (3x3) -Quickly stepping on the court lines when your name is called (Baseline-Service-Singles-Doubles etc.) -Waiting at the baseline line with the ready command and sprinting 5-10 meters (3x2) - Waiting in front of the net and touching the different colored areas on the net with the whistle (3x2) - While standing face down on the floor in the streamline position, they were asked to get up quickly on command and do a 10m sprint (3x2) - While waiting in the streamline position, they were asked to jump up on command. (3x2) - Racket snatching game. (3x2) - Slalom circuits - Throwing and catching exercises - Throwing the tennis ball on the ground and right-left and double hand holding exercises (3x15) - Paired Tennis ball throwing and desired hand holding exercises (3x15) - Standing with back turned and holding the ball thrown from above with different commands (3x15) - Player stands with hands behind his back and holds the ball with the desired hand (3x10) - The player throws a ball to the wall with the right or left hand and catches it with the desired hand. (3x10) - Ball throwing and catching exercises with eyes closed (3x10) - Practice touching colored tennis balls (3x10) - Dexterity circuits - Jumps and direction changes exercises	8-10 min Cool down exercises practiced in the court - Mild tempo cool-down jogging - Static and Dynamic Stretching exercises
5-8. Week	Monday Wednesday Saturday			

Week	Day	Warm-up Exercises	Main Section	Cooling-down Exercises
9-12. Week	Monday Wednesday Saturday		- Reaction ball throwing and holding exercises (3x10) - Throwing and catching a reaction ball with eyes closed (3x10) - Throwing and catching with back turned (3x10) - Forehand-backhand hand lift reaction with racket (3x10) - Forehand-backhand ball throwing reaction practice with backhanded racket (3x10) - Jump rope exercises - Hand-eye coordination and foot-eye coordination activities	

2.3. Vertical Jump Test

The jump heights of tennis players were evaluated with Microgate Optojump® (Microgate, Bolzano, Italy). Athletes were dynamically warmed up for 10 min before the vertical jump performance. The tests were performed twice and the jump heights of the athletes' better tests were recorded. The active jump test, which tests the explosive strength of the leg muscles as well as the elastic strength that affects the explosive strength in jumping, was performed with hands free, knees in full extension and in an upright position by rapidly collapsing from the knees and jumping vertically.

2.4. Reaction Test

Visual reaction times of tennis players were measured with Microgate Optojump® (Microgate, Bolzano, Italy). The subject made a double foot jump at the times determined by the 3 repetitive color change stimulus from the computer and the best reaction time was recorded (Tsolakis et al., 2018).

2.5. Agility t-test

Agility t-test area was used with a scale of 10 meters by 10 meters. Participants ran forward or moved when the “go” order as quickly as possible to the central cone. Then, they ran sideway 5 m to the right cone and ran sideway 10 m away to the far-left cone to the left and ran sideway back to the middle on the right cone. The individual either ran or moved backward as soon as possible to reach the finish line. The researcher began the stopwatch (Casio HS-3V-1R) and stopped when the participant crossed the finishing line plane. The time to complete each test is measured in seconds.

2.6. Stroop Attention Test Administration Instruction and Scoring

The Stroop test is a type of neuro-psychological test that assesses the function of the prefrontal region of the brain, which is responsible for cognitive activities (Stroop, 1935). If the color used in the spelling of the word is not compatible with the color in which the word is shown, the time to express the color will be much longer than in the normal situation. This is considered to be due to the Stroop interference effect. Validity and reliability information about the test was conducted by Tübitak (Kılıç et al., 2002).

The Stroop Test consists of five parts. The five parts and related cards are as follows;

- Card 1: Reading the color names printed in black color
- Card 2: Reading the color names printed in color
- Card 3: Saying the colors of the shapes
- Card 4: Saying the colors of words printed in color but without color names
- Card 5: Saying the colors of words printed in color

Before the Stroop Test was administered, the participants were given comprehensive information about the Stroop Test. The task of the participants in each section was clearly explained. The stopwatch was started with the "Start" command given to the participants. The stopwatch was stopped when the participant completed the last item. In the application consisting of 5 sections, this process was repeated for each section. The times obtained by the participants in each section were noted in the section in the recording form. A slash (/) was drawn over the relevant letter in the recording form for the erroneous responses shown by the participants. When the participants corrected their errors spontaneously, the relevant items were enclosed in a circle (O). After the completion of the Stroop attention test, the number of errors and error corrections for each section were determined and recorded in the relevant section. In the scoring of the Stroop Test TBAG Form, the time from the "Start" command to the reading/saying of the last item of that section, the number of errors and the number of corrected errors were evaluated separately for each section. For each section, the minimum time to complete the reading/saying process, the error score of "0" and the number of corrections of "0" determine the maximum score that can be obtained from the Stroop Test. The total duration of the Stroop Test is 10 minutes (Bozkurt, 2013).

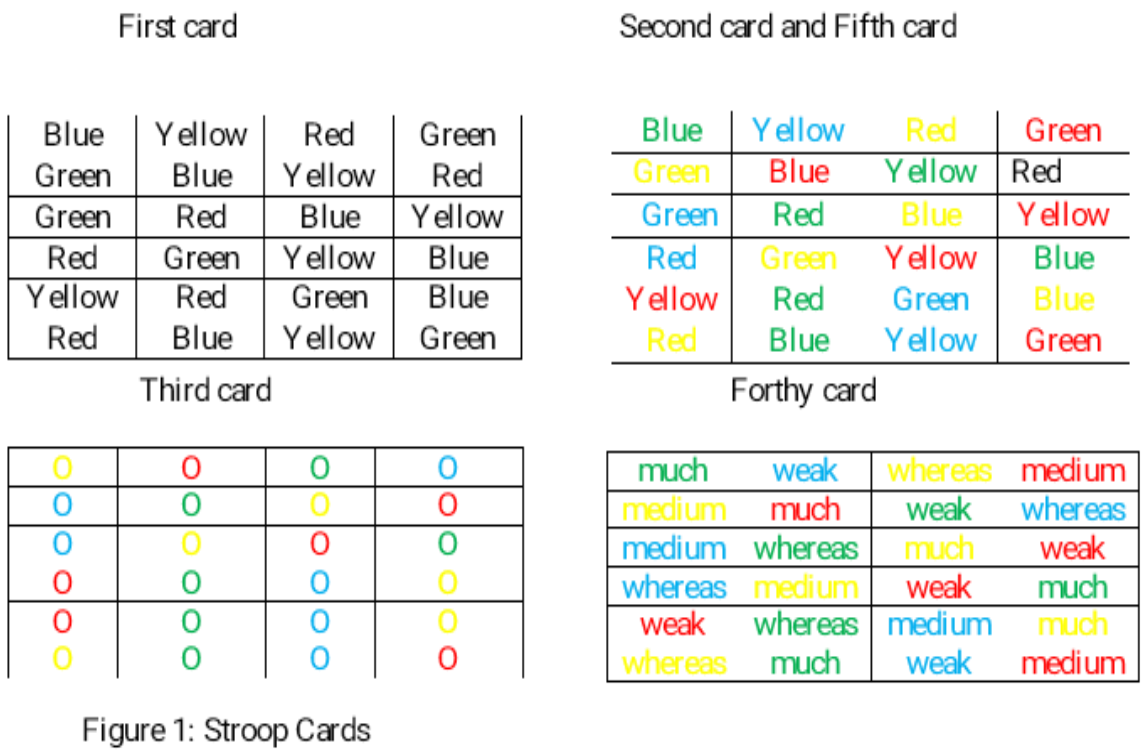

Figure 1

2.7. Data Analysis

Statistical analysis of the collected data was performed using IBM SPSS Statistics 26 package program. The pre-test and post-test data obtained as a result of the measurements were compared by applying the Paired Sample t-test.

3. Results

Results of the study are presented in the tabulated form as follows:

Table 4. *Comparison of Vertical Jump, Agility, Reaction Time and Attention Performances of Tennis Player*

	Study Group				Control Group				Intergroup Comparison	
Test	Pretest	Post Test	t In-Group	p In-Group	Pretest	Post Test	t In-Group	p In-Group	t	p
Vertical Jump (kg.m/sn)	28,08±5,45	28,17±5,88	-0,13	0,90	23,33±5,35	23,58±4,27	-0,31	0,76	2,19	0,04
Agility (sn)	18,84±2,00	17,88±1,85	5,22	0,00	20,51±2,20	20,35±2,13	0,45	0,66	-3,03	0,01
Reaction Time (m/sn)	348,31±30,07	338,32±25,78	1,11	0,29	346,96±72,96	356,29±76,96	-1,24	0,24	-0,77	0,45
Chapter 1 Completion time (sn)	8,86±1,81	8,08±1,43	3,01	0,01	9,42±1,12	9,22±0,87	1,09	0,30	-2,36	0,03
Chapter 2 Completion time (sn)	9,29±1,88	8,81±1,96	3,16	0,01	10,52±2,37	10,52±1,99	1,51	0,16	-2,12	0,05
Chapter 3 Completion time (sn)	11,88±3,41	10,57±2,98	5,32	0,00	12,72±2,02	12,40±2,15	1,28	0,23	-1,72	0,10
Chapter 4 Completion time (sn)	20,31±5,41	17,05±4,62	5,69	0,00	24,38±6,28	23,55±5,31	1,53	0,16	-3,20	0,00
Chapter 5 Completion time (sn)	25,35±7,40	21,36±4,77	3,79	0,00	29,50±5,82	28,14±5,34	2,35	0,04	-3,28	0,00

4. Discussion and Conclusions

The most striking result of this study was the statistically significant changes in the agility, attention and vertical jump performances. In the study, a significant difference was found in vertical jump, agility and attention values ($p>0.05$). No significant difference was found in reaction time measurements.

Attention is one of the most important parameters for tennis sport and it is stated that the level of attention can directly affect the game. In a study examining the effect of 8-week tennis training on attention level in children aged 10-12 years; they concluded that tennis training positively affected attention level (Pişkin & Alpay, 2019). In another study conducted on tennis players, the effect of coordinative ability training on agility and attention was investigated and it was reported that it had a positive effect on attention (Gökbel et al., 2022). It was found that karate training combined with regular physical activity affected the cognitive functions and attention performance of the subjects (Dwojaczny et al., 2021). It is stated that with new and different exercises, different parts of the brain work and therefore new neuronal connections are formed in the brain. As the number of these connections increases, the brain's utilization capacity increases at the same rate (Duda, 2015), thus positively affecting cognitive abilities

such as attention and memory (Johann, et al., 2016). It is emphasized that performing different exercises is effective especially in the adolescent period, which is important for growth and development (Xiaoyang & Haitao 2013, Wensheng & Te, 2014). When the studies on tennis players are examined, it is seen that agility, reaction time and attention come to the forefront in studies in which motor skills are evaluated. Improved agility performance provides the opportunity to change direction more effectively and quickly, which is important for tennis (Sannicandro et al., 2014). In tennis, especially during the competition, the athlete must select, perceive, decide, prepare, and then apply the correct motoric movement in a minimum time frame among all the stimuli that are necessary and important. In the game of tennis, short-term sudden movements, jumps and changes in direction affect performance positively (Eriksrud et al. 2018). In a study investigating the effect of coordinative ability skill training on agility and attention in tennis learning, it was concluded that it had a positive effect on agility (Gökbel et al., 2022). In this study, it is stated that coordinative ability training is effective on multidimensional thinking and therefore fast decision making. It can be said that tennis players who are at a certain skill level with basic tennis training can reach a better performance level with such training.

It has been reported that leg strength, shoulder strength and jumping performance support serving speed in tennis (Hayes et al., 2018). Jumping performance is an important feature to gain an advantage in tennis competitions or to make effective service shots. In this context, it can be said that coordinative ability exercises applied together with basic tennis training affect jump performance. In a study in which the effects of 3 different training programs on speed, reaction time, tennis specific movements and lower extremity power were evaluated on recreational tennis players, significant differences were found in reaction, agility and jump parameters (Salonikidis & Zafeiridis., 2008). In addition to the basic training programs applied, it is mentioned that specific exercises are effective on the jump parameter.

Reaction time is of great importance in tennis. A tennis player needs to perform a quick movement in less than a second (Unierzyski, 2002). Therefore, it was concluded that the inclusion of reaction-improving drills in tennis training and the fact that there was no difference when it was considered that a reaction was shown to every stroke made was due to the inclusion of reaction studies in tennis training. It may be recommended to include more specific drills in the training program for reaction development.

Based on the assumption that different sport activities require different mental skills, coaches should not only focus on the development of motoric parameters, but also ensure the development of cognitive abilities (Alesi et al,. 2016). Motor coordination is the harmonious functioning of body components involving synchrony of gross and fine motor control and motor planning, a multifaceted process with multiple degrees of freedom, in which parts of the same movement are successfully combined to perform a motor scheme (Alesi et al,. 2015). In a tennis match, a tennis player has to keep track of his/her opponent and the incoming ball. At the same time, he/she has to decide what to do against these elements and make the most appropriate move.

In conclusion, when the relevant literature is examined, the number of publications on coordinative ability training applied together with a training program is quite low. Considering that performance is affected by many parameters, it is recommended that such training should be applied by coaches. It is thought that coordinative ability training applied in addition to basic training provides advantages in terms of both development and performance, especially in adolescence

References

Alesi, M., Bianco, A., Luppina, G., Palma, A., & Pepi, A. (2016). Improving children's coordinative skills and executive functions: the effects of a football exercise program. *Perceptual and Motor Skills*, 122, 27-46.

Alesi, M., Bianco, A., Padulo, J., Luppina, G., Petrucci, M., Paoli, A., Palma, A., & Pepi, A. (2015). Motor and cognitive growth following a Football Training Program. *Frontiers in Psychology*, 6, 1627.

Algün, G. (2017). 8 haftalık halk oyunları çalışmalarının 9-11 yaş grubu kız çocuklarda reaksiyon zamanı üzerine etkisi. *İnönü Üniversitesi Beden Eğitimi ve Spor Bilimleri Dergisi*, 3, 41-47. Retrieved from https://dergipark.org.tr/tr/pub/inubesyo/issue/28564/304793

Asan, R. (2011). Sekiz haftalık masa tenisi egzersizinin 9-13 yaş arası çocuklarda dikkat üzerine etkisi. Yayımlanmamış yüksek lisans tezi. Selçuk Üniversitesi Sağlık Bilimleri Enstitüsü, Konya.

Atakurt, E., Şahan, A. & Erman, K. A. (2017). Oryantiring eğitiminin dikkat ve bellek üzerine etkisinin incelenmesi. *Spormetre Beden Eğitimi ve Spor Bilimleri Dergisi*, 15, 127-134. doi: 10.1501/Sporm_0000000327

Bashir, S.F., Nuhmani, S., Dhall, R., & Muaidi, Q.I. (2019). Effect of core training on dynamic balance and agility among Indian junior tenis players. *Journal of Back and Musculoskeletal Rehabilitation,* 32, 245–252.

Bozkurt, İ. (2013). Stroop Testi Uygulama Yönergesi, Erişim adresi: www.onlineterapiler.com Adresinden alınmıştır.

Çağın, M., & Çetin, E., (2022), ‘’Kafein ve Sportif Performans’’, Spor Bilimleri Alanında Uluslararası Araştırmalar V, (I. Baskı), 81-89, Eğitim Yayınevi, Konya.

Çoşkun, M., & Eyuboğlu, E. (2020). Tenis eğitimi alan 10-12 yaş arası erkek çocuklarda temel motorik özelliklerin tenis beceri öğretimine etkisinin incelenmesi. *Spormetre Beden Eğitimi ve Spor Bilimleri Dergisi,* 18, 191-200. doi:10.33689/spormetre.689533

Donnelly, J. E., Hillman, C. H., Castelli, D., Etnier, J. L., Lee, S., & Tomporowski, P. D. (2016). Physical activity, fitness, cognitive function, and academic achievement in children: a systematic review. *Med. Sci. Sports Exerc.* 48, 1197–1222. Doi:10.1249/mss.0000000000000901

Dwojaczny, B., Bejtka, M., Iermakov, S., Potop, V., Yermakova, T., & Cieslicka, M. (2021). Effects of karate training on cognitive functions in young athletes. *Journal of Physical Education and Sport*, 21, 2473-2479.

Ellis, L., Gastin, S., Lawrence, B., Savage, A., Buckeridge, A., Stapff, D., Tumilty, A., Quinn, S., Woolford, S., & Young, W. (2000). Protocols for the physiological assessment of team sports players ın physiological tests for elite athletes. CJ Gore ed. Champaign. *Human Kinetics.* 128-144.

Eriksrud, O., Ghelem, A., Henrikson, F., Englund, J., & Brodin, N. (2018). Upper and lower body power tests predict serve performance in national and international level male tennis players. *Sport Performance and Science Reports,* 42, 1–5.

Fısch, J. (2000) Licht und Gesundheit – Das Leben mit optischer Strahlung. Technische Universität Ilmenau. Ilmenau: Eigenverlag.

Fernandez-Fernandez, J., Ellenbecker, T., Sanz-Rivas, D., Ulbricht, A., & Ferrauti, A. (2013). Effects of a 6-week junior tennis conditioning program on service velocity. *Journal of Sports Science and Medicine, 12, 232-239.*

Ferrauti A., Maier P., & Weber K. (2002), *Tennistraining.* Meyer und Meyer Verlag, Deutchland.

Gökbel, S., Karabulak, A., & Atay, E. (2022). Beyin temelli beceri çalışmalarının tenis öğretimi üzerine etkisinin incelenmesi. *İnönü Üniversitesi Beden Eğitimi ve Spor Bilimleri Dergisi*, 9, 40-51. Retrieved from https://dergipark.org.tr/tr/pub/inubesyo/issue/71327/1172516

Hayes, M.J., Spits, D.R., Watts, D.G., & Kelly, V.G. (2018). "The relationship between tennis serve velocity and select performance measures". *Journal of Strength and Conditioning Research,* 1. https://doi.org/10.1519/jsc.0000000000002440

İbiş, S., & Aktuğ, Z.B., (2018). The effects of sports on the attention level and academic success in children. *Academic Journals,*13, 106-110.

İnce, İ. (2019). Haltercilerde bir alan testi yaklaşımı olarak dikey sıçrama güç kestirimleri ile performans arasındaki ilişkilerin incelenmesi. *Spormetre Beden Eğitimi ve Spor Bilimleri Dergisi*, 17, 48-57. doi: 10.33689/spormetre.529241

Johann, V. E., Stenger, K., Kersten, S., & Karbach, J. (2016). Effects of motor-cognitive coordination training and cardiovascular training on motor coordination and cognitive functions. *Psychology of Sport and Exercise*, 24, 118-127.

Kovacs, M.S. (2009). Movement for tennis: The importance of lateral training. Strength & Conditioning Journal, 31(4), 77-85.

Kılıç, B.G., İlden Koçkar, A., Irak, M., Şener, Ş., & Karakaş, S., (2002). Stroop testi Tbag formunun 6-11 yaş grubu çocuklarda standardizasyon çalışması. *Turk J Child Adolesc Ment Health* 9, 86-99.

Latino, F., Cataldi, S., & Fischetti, F. (2021). Effects of a coordinative ability training program on adolescents' cognitive functioning. *Frontiers in Psychology, 12*, 620440

McBride, J.M., Triplett-McBride, T., Davie, A. & Newton, R.U. (2002) The effect of heavy- vs. light-load jump squats on the development of strength, speed and power. *Journal of Strength and Conditioning Research* 16, 75–82.

Microgate. OptoJump Next. [Internet]. [Place unknown]: [updated 2020 Apr 17]. Available from: http://www.optojump.com/Applications.aspx

Miranda, J. M. D. Q., Polito, L. F. T., Rica, R. L., Miranda, M. L. D. J., Bocalini, D. S., & Figueira Júnior, A. (2020). Muscle strength training and prescribing in competitive tennis players: a systematic review. *Revista Brasileira de Medicina do Esporte, 26*, 87-92.

Parsons, L.S, & Jones, M.T. (1998) Development of speed, agility, and quickness for tennis athletes. *Strength and Conditioning* 20, 14–19.

Planinsec, J. (2002). Relations between motor and cognitive dimensions of preschool girls and boys. *Percept. Mot. Skills* 94, 415–423. doi: 10.2466/pms. 2002.94.2.415

Pişkin, N. E., & Alpay, C. B., (2019). 8 haftalık kort tenisi antrenmanının 10-12 yaş aralığındaki çocuklarda dikkat gelişimleri üzerine etkisi. *Beden Eğitimi ve Spor Bilimleri Dergisi,* 13, 0-0. Retrieved from https://dergipark.org.tr/tr/pub/bsd/issue/53460/711600

Raya, M. A., Gailey, R. S., Gaunaurd, I. A., Jayne, D. M., Campbell, S. M., Gagne, E., & Tucker, C. (2013). Comparison of three agility tests with male servicemembers: Edgren side step test, T-test, and Illinois agility test. *J Rehabil Res* Dev, 50, 951-960.

Roetert, E.P, & Ellenbecker, T.S, (2007) USTA Complete conditioning for tennis. Champaign, IL: *Human Kinetics*, 74–78.

Salonikidis, K,.and Zafeiridis, A. (2008). The effects of plyometric, tennis-drills, and combined training on reaction, lateral and linear speed, power, and strength in novice tennis players. *The Journal of Strength and Conditioning Research.* 22, 182-91.

Sannicandro, I., Cofano, G., Rosa, R.A., & Piccinno, A. (2014). Balance training exercises decrease lower-limb strength asymmetry in young tennis players. *Journal of Sports Science and Medicine.* 13, 397-402.

Sheppard, J. M., & Young, W. B. (2006). Agility literature review: Classifications, training and testing. *Journal of Sports Sciences*, 24, 919-932. http://dx.doi.org/10.1080/02640410500457109

Tsolakis, C., Tsekouras, Y.E., Daviotis, T., Koulouvaris, P., & Papaggelopoulos, P.J., (2018). Neuromuscular screening to predict young fencers' performance, 14, 113-127.

Tunç, A. (2013). Golf sporu yapan çocukların dikkat düzeylerinin incelenmesi. Yayımlanmamış doktora tezi, Selçuk Üniversitesi Sağlık Bilimleri Enstitüsü, Beden Eğitimi ve Spor Anabilim Dalı, Konya.

Unierzyski, P., (2002) In search of data for a long term planning and periodisation in tennis: development vs. results. Antalya: 7. Uluslararası Spor Bilimleri Kongresi. Kongre Kitabı. s.132-141.

Unierzyski, P. (2002). Tenis Gelişim Semineri, Ankara.

Veale, D., &Neziroglu, F. (2010). Body dysmorphic disorder: a treatment manual. Chichester: John Wiley y Sons Ltd.

Verstegen, M. & Marcello, B. (2001). Agility and coordination. B. Foran (ed.). In High Performance Sports Conditioning. Champaign: *Human Kinetics.* 48-58.

Vural, M.U. (2016). Life kinetik antrenmanlarının genç erkek basketbolcularda denge, reaksiyon süresi ve dikkat üzerine etkisi. Yayımlanmamış Yüksek Lisans Tezi. Gazi Üniversitesi Sağlık Bilimleri Enstitüsü, Ankara.

Wensheng, X., & Te, B. (2014). Breakthrough and bottleneck: reflection of women's tennis "solo" career-oriented reform. *J Jilin Sport Univ.* 30, 45–9. doi: 10.3969/j.issn.1672-1365.2014.03.011

Xiaoyang, W., & Haitao, Y. (2013). The study and exploration of tennis player physical stamina training. *J Jilin Inst Phys Educ.* 29, 9-53. doi: 10.3969/j.issn.1672-1365.2013.03.011