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ORIGINAL ARTICLE

Examining of the Effects of Target-Oriented Circular Training on Biomotor Features by using Tennis Ball Throwing Machine at 12-14 Age Tennis Performance Sportsmen for 10 weeks

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ABSTRACT

Aim: In this work, it is aimed that examining the effects of target-oriented circular training on biomotoric features by using a tennis ball throwing machine at 12-14 age tennis performance sportsmen for ten weeks.

Method: This research was implemented on sixteen active licensed athletes who played tennis for at least four years in Ankara. The athletes were randomly divided into two separate groups as the experimental group (n=8) and the control group (n=8). After measuring the height, weight, and fat rate of the athletes, biometric tests were started. Flamingo balance, sit-reach, reaction time, five meters and twenty meters sprints, T-test, and standing long jump tests were performed, respectively. Athletes were get heated for ten minutes before the tests and they were given a trying chance. The best scores were recorded by repeating each test twice. In the statistical analysis of the collected data, IBM SPSS 19 package program was used. In repeated measurements, the results were compared by two-way ANOVA with intergroup, intragroup and post-training data.

Results: As a result, between the experimental group and control group data; on averages of T-Test ($p<0.139$), visual reaction ($p<0.001$), Flexibility ($p<0.024$), Vertical Jump ($p<0.022$), Flamingo Balance right foot ($p<0.046$) and left foot ($p<0.045$) statistical significance was confirmed.

Keywords: Biomotoric features, ITN test, Tennis, Tennis ball machine

INTRODUCTION

Tennis is among the most popular sports branches in the world in terms of the number of athletes and spectators. Technical skill and endurance come to the forefront in today's modern tennis. Every day, new technological developments also affect sports[1]. Tennis training aims at endurance process as well as hitting quality and hit rate. There are not many studies on whether circular training with a tennis ball thrower has an effect on biomotoric features and the effects of machine training. Tennis is a sport in which it is important to be able to throw the ball at the desired angle and depth in the game that requires continuity and precision, and it is extremely important to play with few simple mistakes[2]. The game of tennis is a complex sport that contains very different parameters in terms of its scoring system and court geometry[3].

Its characteristic consists of moderately intense long-term periods, short-term maximal or near-maximal loads together, sudden short runs-stops, repetitive overhead (spikes, serve), and basic strikes (forehand-backhand) movements and rest periods specified by official rules. The tennis ball throwing machine can be used to improve sportsmen's quality of hitting in the training, as it can throw the balls we want at different angles, depths, and speeds in a randomized and controlled manner in training[4,5].

Circular training is a short-term exercise consisting of more than one station, which provides the purposeful development of motoric features and special skills such as strength, speed, endurance, and general skill[6]. Athletes who are engaged in very specific and various sports such as rowing, basketball, football, swimming, cycling, tennis can use it to support their skills in their main sports, as well as in this technique, the athletes will both activate the aerobic energy production systems that they use in their major sports, and they will be able to make the muscles stronger and more durable[7,8].

MATERİAL AND METHOD

Research Group: Sixteen active athletes, who are at high levels in Turkey sorting, participated in this study. Athletes were divided into two groups as the experimental group (n=8) with an average age of 13.125 years and the control group (n=8) with an average age of 13.00 years. Two of the female athletes participating in the study are in the top ten in their age group.

The study was initiated after the consent of the ethics committee with the decision of Ankara Yıldırım Beyazıt University Social and Human Sciences Ethics Committee dated 21.11.2018 and numbered 66 (Appendix-1). Detailed information about the benefits and risks of the study was given to the athletes and their parents who participated in the study. Since the athletes were under the age of 18, after having had parents' autographs and consent the athletes separated, the athletes were included in the study (Appendix-2). It is research that whether there is a chronic and medical health problem in the health status of the athletes.

Data Collectıon: Height, Body Weight, BMI and Fat Measurement: The height of the athletes was measured with a stadiometer with ±1 mm precision. The body weights of the athletes were measured with a TANITA brand with a precision of ±0,1 kg, capable of measuring fat, weight and BMI. Body mass index (BMI)=Weight/Height2 was calculated with the formula[9].

Motorıc Tests: Balance Measurements (Static Balance): The measurements of the athletes who participated in the study were taken thanks to a Flamingo balance board. Each athlete tried to maintain his balance by making as few mistakes as possible for 1 minute by standing barefoot (by

keeping one foot in the air) on the wooden balance beam with a length of 50 cm, a height of 4 cm, and a width of 3 cm. Time was stopped when she lost her balance (dropping her foot, falling off the board, touching the ground with any part of the body). When the athlete got back on the balance board and regained his balance, the previous time was resumed. As mentioned above the test was maintained for one minute. When the time was up, when the athlete lost his balance, so he fell or made the mistakes listed above, an error was counted, and scored by adding up the mistakes made at the end of the time. This test was performed for both feet separately[9].

Standing Long Jump Test: The measurement was taken on a dry surface between the toe tip of the athlete behind the starting point and the heel ending point at the point where he jumped. The athlete was given two trying chance and his best degree was recorded as the score[10].

Speed Test (5m and 20m): A starting line was determined and to run the 20-meter distance at the top speed is wanted from the athlete. The starting point was specified in seconds with photocells placed at 5 meters and 20 meters. Two times the test was performed and the best degree was scored in seconds[11].

Vertical Jump Test: The athlete, leaning through the wall in a side position without shoes, raised her arm close to the wall, touched the top point with her fingertips, and left a mark with the help of the powder that left a trace. The touched point is signed. The distance between the touched point and the arm's length was recorded as a score. The athlete then jumped without any power from her arms and left a mark by touching the highest point. His touched point was noted again. It was repeated three times, and the best degree was recorded in centimeters[12]. After specifying the vertical jump account of the athletes, their anaerobic power was calculated using bodyweight and vertical jump accounts. The Lewis nomogram method was applied to calculate anaerobic power[13]. Thanks to this nomogram, anaerobic power was found as kgm.sn-1 based on the weight of the individual[14].

Agility Test (T-Test): Agility Test (T-Test): The T-test consists of four contact points formed in a T-shape in an area of 10 m length and 10 m width. This test requires alongside two each 90, and 180 degree turns, the total distance of 40 m should cover the distances, 10 m forward, 10 m right, 10 m left, and 10 m back. The athlete walked around the track in the specified direction and direction by passing the photocell at the starting line, and the time when he returned to the starting line at the highest speed and passed through the photocell was recorded[15].

Flexibility Test (Sit and Reach): Sit Reach flexibility test, with a standard flexibility table with a length of 35 cm, a width of 45 cm, a height of 32 cm, and a length of 55 cm on the table, with a further 15 cm protrusion from the footrest, and a 0-50 cm meter on top to measure scores. measurements were made. The tester gave information about the test protocol and the test began. The athlete was seated on the floor, his shoes were removed, and the soles of his feet were flat on the test bench, then by extending his torso and shoulders as far as he can reach forward, arms, fingers stretched, and feet and kneecaps held and stayed by the tester, it was fixed for one or two seconds at the last point and the best score was recorded in cm from two trials[16].

Light Trainer Reaction Device: It is a reaction measurement device that works by touching 5 modules (20 cm between modules) placed in the form of a triangle on the table in random reaction time mode and turning off the light as soon as possible within 1 minute. The lights were LED and red. In order for the lights to switch off, the athlete had to touch 1-2 cm above the light with his hand[17]. The test protocol was explained to the athlete in detail with the light trainer reaction device, and the measurements were taken. The athlete was given 1 chance for warming up and learning the test. The test was performed two times and the best degree was scored. It was taken measurement from an athlete with the body 10 cm away from the table 60 cm high from the floor by sitting on a chair in accordance with the protocol.

Trainıng Programs: Circular Training Applied with Tennis Ball Machine: Circular training consists of eight movements, in which the sequence of movements is given below (7 physical and 1 ball throwing exercise against a Tennis Ball Throwing Machine). After each movement was practiced for 1 minute, 8 movements were completed with 1 minute rest with the voice command of the trainer. Circular work in three sets was done with a 3-minute rest between sets.

Slalom Work: (Figure 1. No:1) The athlete did the slalom exercise at 60-70% HR for one minute through 8 funnels placed on the line 40 cm apart.

Jumping Rope: (Figure 1. No:2) The athlete jumped with a rope pre-set according to the height of each player in the determined area, in one minute, with different combinations of two feet, one foot, and moderate intensity.

Forehand-Backhand without the ball shotting practice (Shadow practice): (Figure 1. No:3) In the basic stance position (Racket with both hands in front, feet shoulder-width apart and knees bent), turn your feet in the direction of the forehand and open the racket one after the other as if there is a ball. By swinging the racket forward, the racquet is pulled up to the shoulder, and then the basic position is taken, and backhand direction is returned, and the racquet is opened and kicked, then the basic posture position is taken, and the practice continues for one minute.

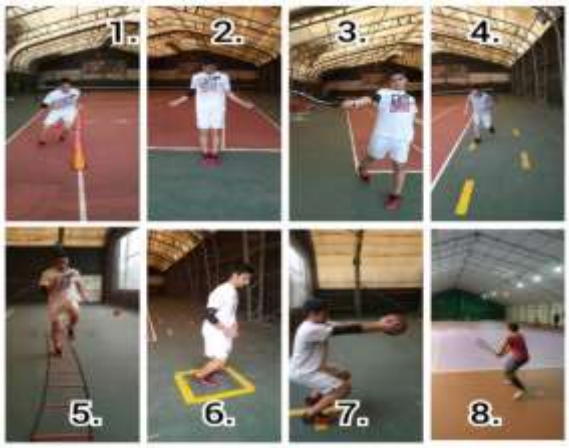

Figure 1. Circular Training Motions

Work of forward and side jump:70 cm. width and 60 cm. as seen in the figure below (Figure 1. No:4), the athlete performed the movement for 1 minute over the lines.

Ladder work: (Figure 1. No:5) The step forward work was completed by pulling the feet to the abdomen, through the ladder consisting of 10 boxes of 35X35 cm sizes, with the body pointing in front of the body, and coinciding with a box at each step.

Square box jumping exercise: (Figure 1. No:6) In the 50X50 cm box, the study was carried out by jumping through a clock direction with double feet, one in and one out.

Squat Stance: (Figure 1. No:7) In the designated area, the athlete holds basketball with both hands, arms stretched, feet bent at 90 degrees from the knees and the body stood upright for one minute without moving.

Target Oriented Work with Tennis Ball Throwing Machine: (Figure 1. No:8) The machine was placed behind the end line of the court at the level of the center of the court. The player tried to hit the ball coming from the machine to the pointed target, moving on his fingertips, in the basic stance position at the center point of the opposite court. The machine ball throwing frequency was reduced to 5 seconds in the first 4 weeks, 4 seconds in the second 4 weeks, and 3 seconds in the last 4 weeks, and the ball throwing speed was performed in the range of 70-90 km/h.

Traditioanal Training Program: As a classical training program, 10 min. knock-up, 50 min. Main Part, 20 min. in-court conditioning exercises, 10 min. Cooling sections have been performed.

Table 1:

Week	Day	Warm-up	Main Section	Cooling
1. Week	Monday	8-10 minutes of warm-up exercises on the court 5 laps of running around the court Different combined runs between 2 lines foot exercises Stairs Study slalom with funnels Skipping rope knee pull jumping exercises Static and Dynamic Stretching exercises	FH-BH Drill Coach Vole-Rally-Points	8-10 minutes Cool-down Practices applied on the court Light jog Static and Dynamic Stretching exercises In-court conditioning exercises 20 min program Rope Jumping Bosu Ball and Medicine Ball Practices, Footwork, Coordination and Agility Practices were done
	Wednesday		Service Return and Drill Points	
	Thursday		FH-BH- Continuity-Depth	
	Saturday		FH-BH- Accuracy Cross Parallel Target Drill	
2. Week	Monday		Rally- Points study	
	Wednesday		Net Front Work Vole Slam Dunk	
	Thursday		FH-BH Drill Coach Vole-Rally-Points	
	Saturday		FH-BH- Continuity-Depth	
3. Week	Monday		Service Return and Drill Points	
	Wednesday		FH-BH- Accuracy Cross Parallel Target Drill	
	Thursaday		Score-Game Short Set study	
	Saturday		Service Return and Drill Points	
4. Week	Monday		Rally- Points study	
	Wednesday		Net Front Work Vole Slam Dunk Short Ball slice	
	Thursday		FH-BH Cross Parallel and Rally Study	
	Saturday		Hand Feed and Trainer Vole drills	
5. Week	Monday		FH-BH Drill Coach Vole-Rally-Pointsv	
	Wednesday		Service Return and Drill Points	
	Thursday		FH-BH- Continuity-Depthv	
	Saturday		FH-BH- Accuracy Cross Parallel Target Drill	
6. Week	Monday		Rally- Points study	
	Wednesday		Net Front Work Vole Slam Dunk	
	Thursday		FH-BH Drill Coach Vole-Rally-Points	
	Saturaday		FH-BH- Continuity-Depth	
7. Week	Monday		Service Return and Drill Points	
	Wednesday		FH-BH- Accuracy Cross Parallel Target Drill	
	Thursay		Score-Game Short Set work	
	Saturday		Servis Return ve Puan Drill	
8. Week	Monday		Rally- Points study	
	Wednesday		Net Front Work Vole Slam Dunk Short Ball slice	
	Thursday		FH-BH Cross Parallel and Rally Study	
	Saturday		Hand Feed and Trainer Vole drills	
9. Week	Monday		FH-BH Drill Coach Vole-Rally-Points	
	Wednesday		Service Return and Drill Points	
	Thurday		FH-BH- Continuity-Depth	
	Saturday		FH-BH- Accuracy Cross Parallel Target Drill	
10. Week	Monday		Rally- Points study	
	Wednesday		Net Front Work Vole Slam Dunk	
	Thursday		FH-BH Drill Coach Vole-Rally-Points	
	Saturday		FH-BH- Continuity-Depth	

Table 2. Physical Characteristics of the Participants.

Physical Properties	Group	N	Average	Standard Deviation
Age	Experimental	8	13,1250	,99103
	Control	8	13,0000	,92582
Sports Age	Experimental	8	5,5000	1,06904
	Control	8	5,2500	,88641
Height	Experimental	8	164,0000	16,39686
	Control	8	161,7500	12,02082
Body Weight Pretest	Experimental	8	55,5000	14,41071
	Control	8	51,4500	12,48862
Body Weight Post Test	Experimental	8	55,5250	13,83822

	Control	8	51,5125	12,54790
Body Fat Percentage Pretest	Experimental	8	19,5250	3,32383
	Control	8	21,1500	5,08302
Body Fat Percentage Posttest	Experimental	8	19,4375	3,05003
	Control	8	21,1875	5,21630
Body Mass index Pre-Test	Experimental	8	20,3000	1,55839
	Control	8	19,4375	2,64139
Body Mass index Posttest	Experimental	8	20,2875	1,25406
	Control	8	19,3500	2,89581

Table 3. Biomotoric Test Statistics.

Biomotoric Tests	Group	N	Pre-test	Post-test	Intra-group chaange (%)	F	P
			X̄ ±SS	X̄ ±SS			
Flamingo Balance Right Foot	Experimental	8	3.62±1.92	2,87±1,45	0.75(%20.71)	2.877	0.046*
	Control	8	4.37±2.06	3,75±1,66	0.62(%14.18)		
Flamingo Denge Sol Ayak	Experimental	8	3.75±1.38	2.87±1.45	0.88(%23.46)	4.831	0.045*
	Control	8	3.62±1.84	3.62±1.76	0(%0)		
Flexibility	Experimental	8	29.75±5.97	31.37±6.09	-1.62(%-5.44)	6.364	0.024*
	Control	8	30.50±8.83	30.87±8.91	-0.37(%-1.21)		
Long jump	Experimental	8	172.62±14.63	178.87±15.44	-6.25 (%-3.62)	2.182	0.162
	Control	8	168.75±26.30	171.62±26.00	-2.87(%-1.70)		
T Test	Experimental	8	12.15±1.24	12.72±1.43	0.57(%4.48)	2.466	0.139
	Control	8	11.86±.99	12.03±1.41	0.17(%1.41)		
5 meters speed	Experimental	8	1.51±.27	1.49±.27	0.02(%1.32)	0.069	0.797
	Control	8	1.41±.32	1.38±.30	0.03(%2.12)		
20 meters speed	Experimental	8	3.84±.34	3.81±40	0.03(%0.78)	3.339	0.089
	Control	8	4.01±.43	3.87±.35	0.14(%3.49)		
Vertical Bounce	Experimental	8	18.37±4.13	19.75±4.65	-1.38 (%-7.51)	0.669	0.022*
	Control	8	19.75±4.65	15.12±2.41	0 (%0)		
Reaction Test	Experimental	8	7140.00±0.00	6445.12±291.10	694.88 (%9.73)	36.087	0.000*
	Control	8	7035.00±478.81	7071.87±417.58	-36.87(%-0.52)		

Data Analysis: IBM SPSS 19 package program was used in the statistical analysis of the collected data. The results were compared with the between-group, in-group and post-training data using two-way ANOVA analysis in repeated measurements. The significance level was accepted as 0.05.

DISCUSSION

Since tennis requires multiple motor skills and high technical skills, tennis players must keep their motoric features and technical skills at a high level. It is extremely important to keep the athletic performance of tennis players at a high level due to their playing time and match performance.

Unierzyski, in his research on 12-year-old male tennis players, found the height of 157.5 cm in category A tennis players and 153.1 cm in category B. While there was no significant difference between the training ages of the A and B groups, these data support the data of our research[18]. In case, Boguslawski's study was aimed to support the training plans of the determined players, to use them in the national team selections, and to develop a few test batteries. In this research, 381 (217 boys and 164 girls) 11-14 years aged athletes at various performance levels took part. Athletes are divided into two groups, group A (at the top international level) and group B (at the national level). At the end of the study, it is shown that the training age of male tennis players in the 12 age group, in the A group was as 5.9 years, and in the B group was as 4.8 years. A significant difference was found between the value of the groups in terms of training age[19]. The body weight of the experimental group was 55.50±14.41 kg in the pretest, 55.52±13.83 kg in the posttest, 51.45±12.48 kg in the pretest and 51.51±12.54 kg in the posttest of the control group is[19]. In the study conducted by Nevill and his friends on school-aged 12-year-old girls (n=324) and boys (n=348) in Greece, they found the mean body weight to be 49.1±11.5 kg for boys and 49.4±11.0 kg in girls[20]. According to the literature, research results were found higher.

Body fat percentages of the experimental group were 19.52±3.22 kg in the pretest, 19.43±3.05 kg in the posttest, 21.15±5.08 kg in the pretest, and 21.18±5.21 kg in the posttest of the control group. Unierzyski, in his research, found the body fat percentage of the athletes in group A to be 15.3 kg and 16.2% in group B among male tennis players in the 12 age group. No significant difference was observed between the total body fat rate of both groups, and these results support our study[19].

Body mass indexes were measured as 20.30±1.55 kg/m2 in the pre-test, 20.28±1.25 kg/m2 in the post-test, and 19.43±2.64 kg/m2 in the control group in the pre-test and 19.35±2.89 kg/m2 in the post-test. In the study of Lovecchio and his friends in Italy, 12-16 age group girls (n=555) and boys (n=529); V.K.I. in girls mean value for 12 years 18.66±3.0 kg/m2, 13 years 17.25±3.3 kg/m2, 14 years old 19.19±2.6 kg/m2, for males 12 years 19.1±3.1kg/m2, 13 years 19.2±3.6 kg/m2 and 14 years they determined the age as 19.7±3.4 kg/m2 [21]. When our research results are compared with the literature, they show similarity in boys and girls.

When the flamingo balance right foot pre-test measurements of the experimental group were examined, it was 3.62±1.92 error rate and 2.87±1.45 error rate in the post-test, while the pre-test measurement of the control group was 4.37±2.06, the post-test measurement was 3.75±1.66. According to the analysis, there was a statistically significant difference at the $p<0.05$ level in the in-group comparison of the experimental group. A significant difference was found at the $p<0.05$ level in the

in-group comparison of the control group.When the difference between the groups was examined, a statistically meaningful difference was found between the two groups. While the experimental group showed improvement by 20.71%, this rate was 14.18% in the control group.

When the flamingo balance left foot pre-test measurements of the experimental group were examined, the error rate was 3.75±1.38 and the post-test 2.87±1.45 error rate, while the pre-test measurement of the control group was 3.62±1.84, the post-test measurement was 3.62±1.76. . As a result of the in-group comparison of the experimental group, a statistically significant difference was observed at the p<0.05 level. However, no difference was observed in the control group. While the flamingo balance feature of the experimental group improved by 23.46%, no improvement was observed in the control group. In the comparison between the groups, a statistically significant difference was found at the p<0.05 level between the experimental group and the control group. Jastrejevskaya stated that balance skill is a criterion for difference between those who perform well in sports skills and those who do not and that motor skills contribute positively to physical development[22]. Suna et al. (2016) studied the effects of coordination training on children's speed, balance, and agility in their study on 12-14-year-old tennis players, and 20 male tennis players participated. The average age of the tennis players was 11.30±0.73 years, the average height was 147.75±3.94 cm, and the average body weight was 40.85±2.03 kg in the pre-test; the post-test measured 40.61±2.02 kg. It is concluded that coordination training is highly correlated with balance[23]. Results show parallelism with the literature. It is observed that being balanced during sudden turns and changing direction in tennis is very important, dynamic and static balance during strokes affects performance positively, and balance losses reduce the quality of strokes. When the results were evaluated, it was seen that the balance feature supported the development of the drills in the Circular working program.

The flexibility feature of the experimental group was examined,so the pre-test measurement was 29.75±5.97 cm, and the post-test measurement was 31.37±6.09 cm. The pre-test measurement of the control group was 30.50±8.83 cm, the post-test measurement was 30.87±8.91 cm. When the flexibility feature was examined, a significant difference was found at the p<0.05 level in the in-group comparison of the experimental group. However, no statistically significant difference was found in the in-group comparison of the control group. In the comparison between the groups, there was a significant difference at the p<0.05 level. While the flexibility feature of the experimental group process by 5.44%, this rate was found to be 1.21% in the control group. ''It is known that flexibility, which is called the level of movement of the joints in the human body within the optimum range of motion, plays an important role in the quality of life and sportive performance of the individual''. In tennis players with insufficient flexibility; Lack of technical learning, increased risk of injury, decrease in the quality of the movement, decrease, and a slowdown in the development of general performance, inhibition in the development of strength and speed characteristics, excessive tension, and stiffness in muscle contractions, similar to worsening of technique due to the unnatural form of movement during the application of technical movements in different sports many problems are encountered[24]. In the study of Measurer et al. in 2011 evaluating the factors affecting the development of tennis skills in children aged 10-14 years, a high degree of significant relationship was found in the study groups with and without the ball[25]. In the study conducted by Cornbleet and Woolsey with 211 women, the average flexibility values of the sit-and-reach test were found to be 24 cm [26]. When the literature is examined, the flexibility values of our study group show parallelism. Flexibility is a feature that develops and regresses day by day. Since our athletes are trained, their flexibility values are above the average. Flexibility is very important in tennis hitting techniques because sudden turns, sit-ups, and accelerations are very common in the game. Flexibility is an important biomotor feature that should be examined in every training to movements at high speed and quality. Dynamic and static flexibility exercises were carried out in our circular training and fitness activities. It is evaluated that the flexibility values were above the average in our athlete group, and it was associated with our fitness activities and BMI and fat ratio values of our athletes.

While the standing long jump value of the experimental group before the training was 172.62±14.63 cm, it was 178.87±15.44 cm in the post-test measurement. While the pre-training value of the control group was 168.75±26.30 cm, the post-test measurement was 171.62±26.00 cm. No statistically significant difference was found in the comparison between groups. While the long jump feature of the experimental group improved by 3.62 cm, this rate was determined as 1.70 cm in the control group. As a result of the literature research (Polat), in his research, it was revealed that there was a significant difference in the standing long jump measurements of the athletes who received branch-specific basic training skills, which showed parallelism with our study[27,36].

The T-test data of the experimental group were examined, so it was measured as 12.15±1.24 seconds before training and 12.72±1.43 seconds after training. The pre-test of the control group was 11.86±.99 sec. post-test 12.03±1.41 sec. was measured. There was no statistically significant difference in the in-group comparison of the control group, but a significant difference was found in the control group at the p<0.05 level. No significant difference was found in the comparison between the groups (p>0.05). While an increase of 4.48% was observed in the T-test feature of the experimental group, this increased rate was 1.41% in the control group. Agility is the control and coordinative skill that ensures that the body and limbs are in the correct position during sudden and rapid turns in a synchronous motion of sequential movements[28]. Agility is a motor skill that is developed and trained with regular exercises[29]. Kaya and Polat conducted a study on 40 tennis players aged 18-23 years in 2018, in their study on the effect of stretching exercises on the ground hitting performance and agility, and concluded that stretching exercises positively affected the T-test data[30]. Piper found statistically significant differences in T-Test measurement results in her study[31]. This study is also similar to our study. The T-test is a test that measures agility. ue to the content of the tennis circular training program, it has shown up as

an expected result to improve agility positively. In the results, an increase was also observed in the control group, it was observed that there was an increase due to the effect of the training.

When the 5-meter speed data of the experimental group was examined before the training, it was 1.51±.27 seconds and the post-test measurement was 1.49±.27 seconds. The control group was measured as 1.41±.32 seconds before the training and 1.38±.30 seconds at the post-test. There was no statistically significant difference in the comparison of the experimental and control groups within and between groups ($p>0.05$). While 1.32% improvement was observed in the five-meter speed feature of the experimental group, this rate was determined as 2.12% in the control group.

When the 20 meters speed data of the experimental group were examined, it was 3.84±.34 sec, the post-test measurement was 3.81±.40 sec, the control group's pre-training was 4.01±.43 sec and the post-test measurement was 3.87±.35 sec. When the 20 meters speed results were evaluated, no statistically significant difference was found in the comparison of the experimental group within the group. However, a significant difference was found at the $p<0.05$ level in the in-group comparison of the control group. No significant difference was found in the comparison between groups. While the 20-meter speed feature of the experimental group increased by 0.78%, the speed feature of the control group increased by 3.49%. Yıldız et al. (2018) investigated the relationship between explosive force and speed on 22 male tennis players aged 12 years, investigating the 0-5 meter acceleration and 20 meter speed values of the athletes. They found 1.226±95.4 seconds for 0-5 meters acceleration and 3.784±243.2 seconds for 20 meters speed test. When compared with the study we have done (Experiment 3.84±.34 sec. Control 3.81±.40 sec.), similarities were observed between them[32]. There is no significant difference in the speed feature since the speed ability develops very little with long-term studies and depending on hereditary characteristics, muscle type, dominant energy system, etc. Since it is a difficult-to-develop feature due to many variables, no increase was considered normal. The lack of improvement in speed ability in our groups can be attributed to the conclusion that the lack of speed training in our circular training system has an effect.

Çimen et al.; In their study, in which they looked at the effect of circular training on a total of (n=16), 16-18 years old male Table Tennis players in 1996, they found a significant difference in the vertical jump values of circular training at the rate of $p<0.05$.[33] In a study conducted by Measurer et al. in 2011 on tennis players aged 12-14, the vertical jump values were determined as 44.7±5.0 cm for males, and female 41.7±5.3 cm. as they found. In another study conducted by Boreham et al. in 1986, the vertical jump results of male athletes in the 12-14 age category were found to be 33.0±5.8 cm on average[33]. When the result of the research is evaluated according to the literature, it shows parallelism, because, in other studies, an increase in vertical jump values was observed with regular training. When the circular training program and machine exercises are combined, it is observed that it increases the vertical jump, and an increase is observed in the split step and continuous jumping and changing direction in the game in the starting positions.

When the reaction time of the experimental group was examined, it was 7140.00±0.00 m/sec., and the post-test measurement was 6445.12±291.10 m/sec. was measured. When the pre-training data of the control group were examined, it was 7035.00±478.81 m/sec, and the post-test 7071.87±417.58 m/sec. was measured. There was a significant difference at the rate of $p<0.05$ in the in-group comparison of the subject group. However, no statistically significant difference was found in the in-group comparison of the control group. In the comparison between the groups, there was a significant difference at the $p<0.001$ level. While the light trainer hand reaction time feature of the experimental group increased by 9.73%, it decreased by -0.52% in the control group. Reaction time; It is a part of the movement speed and is the sum of the time between giving a stimulus to the athlete and starting the movement against the given stimulus. The reaction time affects the stimulus intensity, muscle tone, motivation, training, fatigue, general health, and functional ability of the nervous system. Since reaction time is one of the indicators of neuromuscular performance, it is the most important element taken as a criterion in sportive performance. In their study, Wylie and Kothari's found a significant difference in terms of reaction time in the comparison of the post-training post-test male subject group and the control group, and the reaction time data of the training group turned out to be better[34]. In a study conducted by Özer in 2007 on girls aged 8-11 years, they stated that they improved reaction time by 21.21% in the 8-week mini tennis study, while reaction time improvements were observed at the rate of 6.4% in the control group[35]. In our study, it is similar to the studies in the literature, it was seen that the reaction times of the control group also decreased, but this change was not as high as in the experimental group. It was concluded that the improvement in both groups was the effect of regular training.

CONCLUSION AND RECOMMENDATIONS:

As a result of the research, it can be said that the target-oriented circular training program with a tennis ball thrower applied for 12 weeks to performance athletes between the ages of 12-14 has a positive effect on left and right foot balance skills, agility, flexibility, explosive power, and visual reaction.

The effect seen on biomotoric features is thought to be the effect of regular and systematic training.

In practice, the ball thrower training program can be used to develop and automate batting techniques in group and individual practice. Circular training is a fun and easy application that can be applied for strength and endurance development. Machine workouts can be done to diversify the workout and increase stability. In cases where the athletes have to work individually, they can support their work with ready-made machine programs and programs that they will make individually.

It can be used to improve hitting stability for beginner and intermediate players. With the tennis ball throwing machine, different training programs in different age groups can be applied to larger groups of athletes, making great contributions to the field.

Due to the scarcity of domestic resources in the literature, such studies are needed in the field. It is thought that the use of different training methods and combinations of methods may have a positive effect on athlete performance

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