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Does the Tibialis Flexion Exercise Affects Sprint Performance in Youth Soccer Players?

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Abstract

This study investigated the effects of tibialis flexion exercise on sprint performance in young soccer players. 15 young male soccer players (age: 16.53 ± 1.36 years, height: 180.60 ± 4.36 cm, body weight: 69.80 ± 6.28 kg) playing soccer in the U-17 age category of a professional soccer team voluntarily participated in the study. Before the team soccer training, tibialis flexion exercise was performed 3 times a week. This process continued for 4 weeks. Due to the progressive loading method, 5 repetitions were added to the movement repetition after a training week ended. After the last practice of the week, a 30-meter sprint test was conducted. The test was measured using the "MySprint" application. Every 5-meter piece of the run was compared. As a result of the study, a significant difference in the test results of the last two weeks in terms of duration was observed in different parts of the 30-meter run.

Key Words: Sprint, anterior tibialis, tibialis flexion, soccer

INTRODUCTION

According to the researches, the distances covered by elite soccer players in matches vary between 9-14km (6, 11). In addition, over the distance coverage, players take between 150-250 different types of action. The actions taken depends on the players physical characteristics and the roles in the game (5). Apart from this, relationship between distance coverage with winning the game, creating a position or scoring a goal is quite superficial and it is not possible to being discussed about how the coverage is affecting these aspects (34). The sprint activity is one of the important aspect in soccer, the distance covered with sprints is limited between 1% to 12% total, which corresponds 0.5% to 3% of the playing time (40). Moreover soccer players perform between 3 to 40 sprint activity per game. These numbers may based on the player’s position on the field and it has rarely been seen that the distances covered with the sprint activity exceed 20 meters, or 4 seconds in duration (1). Thus, when if it does not separated according to their positions on the field, average distance covered by 147 soccer players with the sprint activity is 237 + 124 meters and the soccer players speed is more than 24km/h while they travel these distances (6).

Start with to win a soccer match, one team must score more goals than the other team without disqualification. Regardless of soccer player's position, a player playing in the field can score. Besides, the most important players to score goals are the attacking player and the best attacking players are the ones who can score goals (43). In terms of scoring goals being the most important factor in conditions of being winner of the game, how the score is produced has been investigated on a broader spectrum. Accordingly, goals occurred after high intensity activities or high intensity activity was observed at least once in the development of the produced goals. In a sample study, 298 of the 360 goals (83%) scored in the German National League showed at least one high intensity activity performed by the player who scored or gave the pass to the scorer. Thus, the high intensity activity that stands out in those goals or assists is the sprint activity which is dominant activity for scoring (15). According to the same research, the goals scored was formed after the attacking player's high intensity run (sprint) without dribbling the ball (dummy run). The truth of a previous assertion may be confirmed or contradicted by, in the researches, athletes with high sprint speeds can pass the defenders more easily, their scoring percentages are higher, they create more effective shooting positions and the percentage of goalkeepers to save these shoots are less likely (41,42). Likewise, it was observed that the games won in the German National League, attacking and midfielders covered a higher number of sprint distances than in the games lost (2). It can be said that sprint activity is important in soccer and can increase the success rate when its improved. Managers and athletic performance coaches use training methods which improves sprint ability, both before and during their season. But, in a sport such as soccer, it is difficult to implement these methods and versatile training plans for various reasons. Firstly, soccer is a team game and that a high amount of time for training should be allocated to technical and tactical training. Therefore, the technical team and coaches would spend more time on tactical training instead of doing any extra physical work if there are no major deficiencies. In addition to that, considering the travel time and rest requirements of the soccer players, it is difficult to do extra physical training during the season (25).

Sprint is called the running of people with unaided movements with maximal exertion (22). Sprint ability can be improved with various methods. These are; improving and correcting of running technique, strengthening the muscles of the lower extremities, making the lower extremity muscles more durable, fitness applications that can be applied for power generation and basically sprinting more often (3,8,24,31,37). According to the studies, the muscles of the lower extremities affect the different phases of the sprint in different ways. Knee flexors and plantar flexor are significantly important factors in the first 15 meters of a 40 meter sprint run (10). Also, knee extensors, plantar flexors and hip extensors are effective in the power generation of 35 meters of sprint activity (15). Conforming to the literature review and the studies observed, technical-tactical training in soccer has been given priority and development of the physiological aspects of the players is put on the second plan, especially during the season. The reason behind this situation is in order to use the time economically because the trainings which can improve the physiological aspects can take long process and the adaptation would take a long time. (13, 23). These reasons and situations shows that there is a need for new methods which have valid that can be implemented for improve physiological aspects of soccer players during the season. Researches shows, improvements on knee extensors, knee flexors and hip muscles positively affects sprint performance (7, 9, 35). However, there is no scientific research shows that development of tibialis anterior which is a lower extremity muscle, can increase sprint performance. It is known that the tibialis anterior muscle appears to be more active than other muscles during certain phases of running (30, 33). The aim of this study is to find out whether exercise performed to improve tibialis anterior muscles affects sprint performance in young soccer players.

METHODS

Study Design

The study consisted of 4 weeks starting from the first test to the last test as a total of 5 tests and 12 exercises (Table 1). The training was held 3 days a week in the facilities where the club trained. After the height and body weight measurements were taken from the participants on the first day of the first week, a 30-meter sprint test was applied and then they were allowed to do their first training after taking enough breaks to rest. Then, each subsequent week, a 30-meter sprint test was performed before the third training day (Table 1). All the practices were performed in the first part of the workout. Apart from the practices, the athletes continued their routine training. The researchers progressively increased their exercise repeat count each week throughout the training protocol. After the training, passive stretching exercise was applied to reduce the risk of injury of the participants. For the last measurement only, it was ensured that 48 hours had passed since the last training time.

Table 1. Table showing the days that the subjects will participate in the study and in which studies the measurements were taken.

Week 1	Week 2	Week 3	Week 4
Day 1 – Body height and weight, 30m Sprint measurements and first training	Day 1– training	Day 1– training	Day 1– training
Day 3– training	Day 3– training	Day 3– training	Day 3– training
Day 5– 30m Sprint measurement and training	Day 5– 30m Sprint measurement and training	Day 5– 30m Sprint measurement and training	Day 5– training
Day 6 - rest	Day 6 - rest	Day 6 - rest	Day 6 - rest
-	-	-	Day 7 – Last 30m sprint measurements

Subjects

Fifteen male athletes (age: 16.53 ± 1.36 years, height: 180.60 ± 4.36 cm, body weight: 69.80 ± 6.28 kg) playing in the U-17 age category of a professional soccer team voluntarily participated in the study. Since the participants were under the age of 18, parental consent was also obtained. The study included athletes who had not experienced a serious injury in the past year. It was explained that the participants should not apply any extra resistance exercises other than their own routine training throughout the study. The working group did not include goalkeepers. Each participant continued their routine training throughout the study but were asked not to train strenuously and not to use beverages such as caffeine and alcohol 24 hours before the study and test days. Any positive and negative situations that may arise during the study are explained to the participants, their families and coaches.

Procedures

Athletes have practiced a warm-up procedure that they routinely practice, which includes low intensity running, specific soccer practices that are not strenuous and dynamic stretches. Then they performed the tibialis raise exercise. After all sets of exercise were completed, the athletes performed two sets of static calf raise exercise for 30 seconds to cool down.

Tibialis raise exercise is an exercise performed by performing ankle dorsiflexion. Participants lean their backs to a place where they can get support and position their feet about a step and a half forward. Before athletes begin exercise, make sure that part of their back, waist, and hips touch the place where they receive support. When athletes are in this position, they statically fix their knees at the maximum extension angle and perform dorsiflexion with their ankles. They waited 1 second at the maximum dorsiflexion angle and 1 second when the sole of their feet pressed the ground again.

When all the sets of exercise were finished, calf raise exercise was applied as a cooling exercise to prevent injury to the tibialis anterior muscle. Calf raise can also be considered as a resistance exercise, but here it is treated as a stretching exercise due to the extension of the tibialis anterior muscle. While performing the calf raise exercise, the athletes waited for 30 seconds by rising to the tips of their toes and rested for the following 1 minute. In this way, they applied a total of 2 sets and the training part of the experiment was completed.

In the tibialis raise exercise, the progressive overload method was applied to ensure that the development continued, so the number of repetitions was increased by a certain amount every week. In the first week, the exercise was practiced in 3 sets of 15 repetitions and 5 repetitions were added to the number of repetitions each week. Therefore, in the last training, the participants performed the exercise 3 sets and 30 repetitions. Due to the fact that the gastrocnemius muscle works statically while flexing the tibialis anterior muscle, no change has been made in the duration of the cooling exercise and the number of sets in order to limit the predicted development.

Table 2. Table of exercise set and repetition counts.

	Week 1	**Week 2**	**Week 3**	**Week 4**
Tibialis Raise	3x15, x-1-0-1	3x20, x-1-0-1	3x25, x-1-0-1	3x30, x-1-0-1
Calf Raise	2 x 30 seconds	2 x 30 seconds	2 x 30 seconds	2 x 30 seconds

The first of the numbers that appear in the table as 3x15 symbolizes the number of sets, and after the x, the number of repetitions.

MySprint

Mobile apps are frequently used by sports scientists and strength and conditioning coaches (16). Due to the difficulty of accessing measuring devices and economic reasons, sports scientists and coaches have started to use mobile applications (26). The increase in the use of mobile applications has led to the questioning of the reliability of the applications. The "MySprint" application we use has been evaluated by some studies in terms of reliability. When the evaluation results were examined, near-perfect correlation values were recorded between the use of photocells and the MySprint application. As a result of the systematic evaluation of the study, the MySprint mobile application was evaluated as a valid and reliable application for motion speed measurement, motion time evaluation and power output measurement (38).

The 30 meter running tests were recorded and analyzed with the "MySprint" application. The procedure in the mobile application was followed for the recording of the 30-meter test. For the measurement, 6 markings (long training sticks) that can be easily detected by the camera were used. These signs are placed in the 5-10-15-20-25 and 30 meter zones of the 30-meter running area, respectively. The camera used is located at a distance of 10 meters from the mark at 15 meters for the chest of the running athlete to record comfortably, and different distances for 5, 10, 20, 25 and 30 meters are also referenced.

The reference points on doors A (5 and 25 meters) are parallel to the camera angle (appropriate), but also 0.57 meters away from the 5 and 25 meter transition points, parallel to the camera angle for the reference points at gates B (10 and 20 meters) and 0.28 meters away from the transition points, and finally the reference points at point C are parallel to the camera angle (appropriate) and 0.85 meters away from the transition point set. In order to ensure that the participants could accelerate, the participants were asked to start 50 cm behind the starting point of the 30 meter running track. When the participants were ready, they started the test.

Statistical Analysis

After the measurements were taken, the data were processed with the "SPSS 22" program. First of all, the normality analysis of the data was made. Since the data were homogeneously and normally distributed, the "One Way ANOVA" test was applied and analyzed at 95% confidence interval. The evaluation between each examined data was made according to Post-Hoc. It has also been interpreted according to Scheffe, Bonferroni, Tukey.

FINDINGS

In this study, it was observed that the participants had a decrease in their 30 meter sprint time as a result of 4 weeks of training and one test every week (every 3 exercises were over). According to the results obtained, it was observed that the duration of the participants did not change between the 1st week, the 2nd week and the 3rd week in the 5 meter sprint duration. Likewise, it was determined that the durations of 10 meters, 15 meters, 20 meters, 25 meters, 30 meters sprint durations did not change in the 1st, 2nd and 3rd weeks. When looked at in more detail, it was observed that the exercises performed during the sprint periods of the participants in the first week produced a relative change. However, when looking at the 4th and 5th week, it is found that there is a significant change in the transition times for every 5 meters sprint distance.

Table 3. The results of the 30-meter sprint test based on the interpretations of Bonferroni, Scheffe and Tukey.

	Week 1		Week 2		Week 3		Week 4		Week 5	
	Means (sec)	**S.s. (±)**	**Means (sec)**	**S.s. (±)**	**Means (sec)**	**S.s. (±)**	**Means (sec)**	**S.s. (±)**	**Means (sec)**	**S.s. (±)**
5 meters	1.00	0.06	0.98	0.04	0.93	0.07	0.87*	0.09	0.82^{α}	0.12
10 meters	1.72	0.09	1.70	0.05	1.67	0.08	1.60*	0.09	1.54^{α}	0.12
15 meters	2.34	0.10	2.37	0.06	2.34	0.08	2.25*	0.10	2.20^{α}	0.13
20 meters	2.96	0.12	3.01	0.08	2.98	0.10	2.89*	0.11	2.80^{α}	0.14
25 meters	3.58	0.15	3.61	0.10	3.63	0.12	3.51*	0.13	3.41^{α}	0.14
30 meters	4.19	0.18	4.28	0.13	4.27	0.14	4.13*	0.15	4.05^{β}	0.16

* Significant for week 1,2,3,4 ($p < 0.05$), $^{\alpha}$ significant for week 1,2,3 ($p<0.05$), $^{\beta}$ significant for week 2,3($p<0.05$).

As a result of the analysis of the data, the findings of Bonferonni, Scheffe and Tukey based on the interpretations of the tibialis raise exercise performed on young soccer players;

- At the 5, 10, 15 and 20 meters; In the 4th week according to the 1st and 2nd week, in the 5th week according to the 1st-2nd-3rd weeks,
- At 25 meters; In the 5th week according to the 1st-2nd-3rd weeks,
- In 30 meters, a statistically significant difference was found in 5th week compared to 2nd and 3rd week.

Table 4. Results of one-way ANOVA.

	Sum of squares	**df**	**Mean Square**	**F**	**d**
5 meters	0.344	4	0.86	13.040	0.000
10 meters	0.319	4	0.80	10.428	0.000
15 meters	0.315	4	0.79	8.444	0.000
20 meters	0.432	4	0.108	8.628	0.000
25 meters	0.491	4	0.123	7.369	0.000
30 meters	0.556	4	0.139	5.926	0.000

Looking at the "One-Way ANOVA" results of the participants; There were significant differences between the participants' 5 meter transition time of the exercise performed each week ($p<0.05$). A significant difference was found between the first test observed and the last test. As a result, it was observed that the tibialis raise movement had an effect on the 30-meter sprint speed of young soccer players as a result of a 4-week program.

DISCUSSION

There are many studies in the literature related to the development and importance of sprint running in soccer. In some of these studies, we can mention the existence of studies that conclude that the development of the muscles of the lower extremities plays an important role for the development of sprinting skills (39). However, there is a lack of studies in the literature specifically considering the effect of anterior tibialis development on sprint in soccer.

Based on the information provided, the aim of the study was to investigate the effects of the tibialis raise exercise applied to soccer players on sprint performance. In line with the aim of our study, the effects of tibialis raise movement on sprint performance in soccer players were determined with the training process lasting 4 weeks and performed 3 times every week. When the results were examined, it was seen that tibialis raise exercise had significant effects on the development of sprint performance.

According to a study, 49% of the distance covered by soccer players in the sprint during the match is shorter than 10 meters and 96% is shorter than 30 meters (37). With the data we obtained from our study, we can say that our training improves the performance of the soccer players within the expected sprint distance.

In a study by, it was found that the fastest soccer players were (approximately) 0.6 seconds slower than the fastest sprinters in the world at runs over 40 meters (17). In addition, when the individual test results in the latest studies are examined, it has been determined that the fastest male soccer players can reach 40-meter sprint performances equivalent to the 60-meter run finalists at the national athletics championships. The 1 on 1 situation in soccer requires being faster than the opponent or eliminating the opponent. He said that about 30 to 50 cm is enough to rule out the opponent with the body or shoulder in 1-on-1 situations in soccer. The meaningful results we have achieved in our work play an important role in these critical situations and characteristics related to sprinting in soccer.

Running consists of cycles and certain phases of cycles. For the running skill to be realized correctly, all the elements of these cycles must work in synchronization. With the end of the support phase (stance) of the run, the plantar flexors cease their activity and the tibialis anterior activity for foot dorsiflexion begins (36). During the flight phase of running, the rectus femoris and tibialis anterior are highly active muscles (27). In the data determined as a result of the study, the duration of the 30 meter run in the fourth and fifth week of the training was determined in the 5-10-15-20 meter phases. While the average duration of the 5th week of 5 meters was 0.82, the durations of the 1st, 2nd and 3rd weeks were recorded as 1.0-0.98 and 0.93, respectively. With these data, it can be concluded that the tibialis is related to the development of the anterior muscle.

With dorsiflexion, especially during the oscillation phase of the sprint, the anterior tibialis becomes the most active. In his study by Tom F. Novacheck (1998), he said that elite athletes used the forefoot area very actively during the sprint and thus showed their performance, and that the heel area did not even touch the ground (28). Lockie et al. (2013) also said that for the 10-meter running time to improve, there should be longer steps, longer flight time and shorter contact time (20). With the conclusion reached in our study, the tibial raise exercise a. We can say that it plays an active role in the development of tibialis and therefore in the development of sprints. However, we can state that the development of anterior tibialis will have a positive effect on the duration of release.

The tibialis anterior muscle contracts concentrically during the sprint and the foot is stabilized. In addition, it maintains speed by moving the tibia forward on the foot (21). When we compare the 25 and 30 meters data of the fifth week of our study with the 25 meters data of the first, second and third weeks, and 30 meters of the second and third weeks, we see the improved sprint time. At the end of the 4-week training period, we can say that the 30 meter runs in the first weeks improved the sprint times.

The calf raise exercise performed after the tibialis raise exercise in our study aims to prevent excessive hypertrophic development due to tibialis raise exercise by providing stretching by performing statically. On the other hand, it also causes the development of the gastrocnemius muscle. In a study by Prilutsky and Zatsiorsky (1994), it was said that the rectus femoris and gastrocnemius muscles help to extend the joints by carrying mechanical energy to the distal joints (32). Based on this, it can be said that the calf raise exercise we do has an effect on the sprinting skills of our participants.

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