



# Relationship Between Foot Muscle Strength with Achilles Tendon Thickness and Plantar Fascia Thickness

## Ayak Kas Kuvveti ile Aşil Tendonu Kalınlığı ve Plantar Fasya Kalınlığı Arasındaki İlişki

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### Abstract

**Aim:** There is essential coordination between foot muscle strength, Achilles tendon, and plantar fascia. This study aims to show the mathematical relationship between foot muscle strength and plantar fascia thickness and Achilles tendon thickness.

**Material and Method:** The study was conducted with 57 volunteering individuals (30 males, 27 females) between the ages of 18 and 40. Plantar fascia thickness and Achilles tendon thickness were measured with the ultrasound. Foot muscle strength was measured with a digital hand dynamometer. The data obtained were statistically evaluated.

**Results:** A positive, moderately strong correlation was found in men between left side Achilles tendon thickness and plantar fascia thickness ( $p<0.05$ ). A positive, reasonably strong relationship was found in women between left foot muscle strength average and plantar fascia thickness ( $p<0.05$ ). However, in all groups, the right foot muscle strength average had a positive, moderately strong correlation with Achilles tendon thickness and plantar fascia thickness ( $p<0.05$ ). In all groups, it was found that the right-side Achilles tendon thickness had a positive, moderately strong correlation with plantar fascia thickness ( $p<0.05$ ). On the other hand, when the genders were compared, a statistically significant difference was found between right foot muscle strength and plantar fascia thickness and Achilles tendon thickness ( $p<0.05$ ).

**Conclusion:** We believe that the fact that there are different results between men and women and even on the right and left sides of the same gender will be useful, especially in terms of clinic physicians' approaches towards diagnosis and treatment.

**Keywords:** Achilles tendon, plantar fascia, muscle strength, foot, plantar flexion

### Öz

**Amaç:** Ayak kas kuvveti, aşil tendonu ve plantar fasya arasında temel bir koordinasyon vardır. Bu çalışma, ayak kas kuvveti ile plantar fasya kalınlığı ve aşil tendonu kalınlığı arasındaki matematiksel ilişkiyi göstermeyi amaçlamaktadır.

**Materyal ve Metot:** Çalışma; yaşları 18 ile 40 arasında değişen, gönüllü 57 birey (30 erkek, 27 kadın) ile gerçekleştirildi. Ultrason ile plantar fasya kalınlığı ve aşil tendon kalınlığı ölçüldü. Ayak kas kuvveti dijital el dinamometresi ile ölçüldü. Elde edilen veriler istatistiksel olarak değerlendirildi.

**Bulgular:** Erkeklerde sol aşil tendon kalınlığı ile plantar fasya kalınlığı arasında pozitif, orta derecede güçlü bir korelasyon bulundu ( $p<0.05$ ). Kadınlarda sol ayak kas kuvveti ortalaması ile plantar fasya kalınlığı arasında pozitif, anlamlı güçlü bir ilişki bulundu ( $p<0.05$ ). Ancak tüm gruplarda sağ ayak kas kuvveti ortalaması ile aşil tendon kalınlığı ve plantar fasya kalınlığı arasında pozitif, orta derecede güçlü bir korelasyon vardı ( $p<0.05$ ). Tüm gruplarda sağ Aşil tendonu kalınlığı ile plantar fasya kalınlığı arasında pozitif, orta derecede güçlü bir korelasyon olduğu bulundu ( $p<0.05$ ). Öte yandan cinsiyetler karşılaştırıldığında sağ ayak kas kuvveti ile plantar fasya kalınlığı ve aşil tendonu kalınlığı arasında istatistiksel olarak anlamlı fark bulundu ( $p<0.05$ ).

**Sonuç:** Kadın ve erkek arasında ve hatta aynı cinsiyetin sağ ve sol taraflarında bile farklı sonuçların bulunmasının özellikle klinik hekimlerinin tanı ve tedaviye yaklaşımları açısından faydalı olacağı kanaatindeyiz.

**Anahtar Kelimeler :** Aşil tendonu, plantar fasya, kas gücü, ayak, plantar flexion

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## INTRODUCTION

Achilles tendon (tendo calcaneus) is the common tendon of gastrocnemius muscle and soleus muscle (sometimes plantaris muscle is also included). It is the most robust, comprehensive and thickest tendon of the human body (1-3). Approximately 70% of its structure consists of collagen fibers (4). It has a significant role in conducting moves, such as walking, running, jumping and in the biomechanics of the lower extremity (5). In addition to being the strongest tendon of our body, Achilles tendon is the most frequently injured tendon due to its anatomic region and being used intensively concerning function (1). Achilles tendon may show various pathological situations. These injuries generally occur in the ankle part. It is of considerable importance to know the functional anatomy of Achilles tendon in detail to reveal the effects of these pathological situations on the functions of Achilles tendon and to be able to plan the period of treatment how we administer the treatment (6).

Plantar fascia or plantar aponeurosis starts from the medial tubercle at the calcaneus and ends by attaching to the plantar part of the metatarsophalangeal joint (7-9). Studies conducted have shown that plantar fascia statically and dynamically supports the longitudinal arch of the foot and that plantar fascia resists to shocks the foot is exposed to (10). While plantar fascia gives active support to the arch of the foot in the advancing phase of walking, at the same time, it prevents the deterioration of the foot shape passively (11). Also, ptosis has been observed in the arch of the foot following plantar fasciotomy. It has been shown that plantar fascia may show severe tension, especially in situations, such as lifting weight and carrying a load (12). A study show a positive correlation between Achilles tendon and plantar fascia tension (13). For the stability of the arch of the foot and for the plantar to show resistance against the load being carried, the correlation of plantar fascia and Achilles tendon is essential.

In the case of weakness of the muscles supporting the longitudinal arch, the amount of stress on non-contractile plantar fascia increases (14). Besides, weakness in gastrocnemius muscle and soleus muscle, Achilles tendon and intrinsic foot muscles are considered as a risk factor for plantar fascia (15-17).

There is critical coordination between foot muscle strength, Achilles tendon and plantar fascia. This study aims to show the mathematical relationship between foot muscle strength, plantar fascia thickness and Achilles tendon thickness.

## MATERIAL AND METHOD

### Type of the Study

To conduct this study, ethical approval was obtained from Uşak University Faculty of Medicine Non-Interventional Clinical Research Ethical Board with the decision numbered 83-06. This study was conducted with 57 volunteers (30 males, 27 females). The study's aim was

explained verbally to all the participants who participated in this study, and they signed an "informed volunteer consent form."

### Inclusion criteria were as follows:

- Healthy, volunteering asymptomatic individuals between the ages of 18 and 40

### Exclusion criteria were as follows:

- Heel pain
- Plantar fasciitis
- Those with sensory heel pain
- Those with nerve compression
- Those who had diabetes mellitus
- Those with inflammatory joint disease
- Individuals who underwent foot surgery
- Those who did active sports activities or those still doing

After the participants' height and weight measurements were made, body mass index (BMI) was calculated.

### Foot muscle strength measurement

One of the first devices that are accepted as reliable for isometric muscle strength measurement is digital hand manometers. In a study that compared measurements made using digital hand dynamometers and isokinetic dynamometer, a strong correlation was found between measurement values (18, 19). A study that compared three different hand dynamometers found that measurements made with MicroFet showed fewer differences with an isokinetic dynamometer (20, 21). In our research, a MicroFet hand dynamometer was used to assess foot muscle strength (MicroFet2™, Hoggan Health Industries, West 130 Jordan, UT, USA). In addition to the high reliability of MicroFet2™, its ease of use, portability, cost, and compact size have already been considered in studies.

Muscle force measured in Newton (N) with a 4 cm-wide transducer pad. All muscle strength tests were performed by the same physiatrist. Plantar flexion involves a coordinated effort between several muscles in the ankle, foot, and leg. These include gastrocnemius, soleus, plantaris, flexor hallucis longus, flexor digitorum longus, and tibialis posterior muscles. Strength ability tests for plantar flexors were performed. For evaluation, the volunteers sat on the edge of a chair with the only heel touching the floor and arms crossed in front of the body. The volunteer was asked to keep their buttocks on the chair and make a plantar flexion to the ankle joint without a swing movement. The transducer was placed between the distal part of the foot and floor. No warm-up was performed before testing. A higher score represents better muscle strength ability.

### Ultrasound (US) screening technique

After the volunteers lay on the examination table in the prone position, their ankles were brought to flexion, and

Achilles tendon thickness and plantar fascia thickness were measured. Measurements were made on the right and left feet of all individuals. A standard ultrasound gel was used to obtain a clear image. A linear ten megahertz probe (MINDRAY DC-8 EXP Mindray DS USA, Inc.) was used. A physiatrist made measurements and assessments of both sides. The probe was placed vertically to the long axis of the Achilles tendon. After a general evaluation was made on the axial plane, thickness (anteroposterior) measurement was made from the lower side of the medial malleolus (Figure. 1).

Foot soles were kept in the same position, and plantar fascia thickness was measured from the attachment point to the calcaneal tubercle in longitudinal appearance (Figure. 2).

Participants had anomalies, such as calcification, plantar fasciitis, bursitis, tendinopathy, or calcaneal irregularities, were excluded from this study.

### Statistical Analysis

IBM SPSS version 22.0 software (IBM Corp., Armonk, NY, USA) program was used in statistical analysis. The normality distribution of the data was tested using the Kolmogorov-Smirnov test and the findings showed that

data were not normally distributed. The data were given as median (min-max). The Mann-Whitney U test was used in the comparison of genders. The data which were not normally distributed were analyzed using Spearman Rho correlation analysis. The limits of the correlation coefficient were assumed to be between -1 and +1. While the correlation coefficient, whose magnitude is between 0.5 and 1.0, indicates variables are considered highly correlated, those between 0.3 and 0.5 are moderately correlated and those between 0 to 0.3 have a low correlation (22).

### RESULTS

Median (min-max) values of the participants' age, height, weight and BMI variables are given in Table 1. The median value of all the individuals who participated in this study was 19 years, the median value of height was 175 cm, the median value of weight was 66 kg and the median value of BMI was 22.6. Mann-Whitney U test was conducted on the data to investigate whether there were statistical differences between men and women concerning the variables of age, height, weight and BMI. According to the Mann-Whitney U test conducted, there was a statistically significant difference between men and women concerning age, weight and BMI ( $p < 0.05$ ) (Table 1).

**Table 1. Median (min-max) values of the groups' age, height, weight and BMI variables**

Group	Age	Height (cm)	Weight (kg)	BMI
Male	19 (18-21)	178 (169-195)	76.5 (49-100)	24.2 (16-30.5)
Female	19 (18-27)	163 (153-183)	55 (45-100)	20.2 (16.5-35.4)
p value	0.204	0.000*	0.000*	0.006*

\* $P < 0.05$  statistically significant

Median (min-max) values of the participants' right and left muscle strength averages, Achilles tendon thickness and plantar fascia thickness variables are given in Table 2.

Spearman Rho correlation analysis was conducted on the data to find out how participants' variables of muscle strength average, Achilles tendon thickness and plantar fascia thickness taken from their right foot differed with age, height, weight and BMI. The analysis results showed that right side Achilles tendon thickness in men had

a moderately strong correlation with weight and BMI ( $p < 0.05$ ). As the whole group, the findings showed that the right foot muscle strength average had a strong positive correlation with height and weight and a weak positive correlation with BMI ( $p < 0.05$ ). Right side Achilles tendon thickness had a positive moderate correlation with height, weight and BMI ( $p < 0.05$ ) and the right side plantar fascia thickness had a positive weak correlation with weight ( $p < 0.05$ ) (Table 3).

**Table 2. Median (min-max) values of the groups' right and left foot variables**

Side	Group	Muscle Strength Average (Newton)	Achilles Tendon Thickness (mm)	Plantar Fascia Thickness (mm)
Male	Male	117.2 (74.6-245.2)	0.47 (0.33-0.62)	0.32 (0.19-0.44)
	Female	85.5 (46.9-119)	0.43 (0.32-0.57)	0.29 (0.2-0.36)
	All Group	104 (46.9-245.2)	0.46 (0.32-0.62)	0.31 (0.19-0.44)
Left	Male	119.5 (81.8-223)	0.45 (0.29-0.66)	0.32 (0.2-0.46)
	Female	82.8 (44.7-155.6)	0.42 (0.32-0.55)	0.3 (0.18-0.36)
	All Group	107.4 (44.7-223)	0.42 (0.29-0.66)	0.31 (0.18-0.46)

Spearman Rho correlation analysis was conducted on the data to find out how participants' variables of left foot muscle strength average, left side Achilles tendon thickness and plantar fascia thickness differed with age, height, weight and BMI. The findings showed that left foot Achilles tendon thickness in men had a strong positive correlation with weight and BMI ( $p < 0.05$ ). As the whole group, the left foot muscle strength average had a strong positive correlation with height and weight, and a weak positive moderately strong correlation with BMI

( $p < 0.05$ ). The left Achilles tendon thickness had a positive moderately strong correlation with weight and a strong positive correlation with BMI ( $p < 0.05$ ) (Table 4).

Spearman Rho correlation analysis was conducted on the data to find out the correlation between right foot variables of the participants. In all groups, right foot muscle strength average had a positive moderate correlation with Achilles tendon thickness and plantar fascia ( $p < 0.05$ ). Achilles tendon thickness had a positive moderately strong correlation with plantar fascia ( $p < 0.05$ ) (Table 5).

**Table 3. Spearman Rho correlation analysis results between the groups' age, height, weight and BMI variables and right foot variables**

Groups	Variables	Statistics	Muscle Strength Average	Achilles Tendon Thickness	Plantar Fascia Thickness
Male	Age	r	-0.035	0.146	0.191
		p	0.854	0.442	0.313
	Height	r	0.206	0.191	0.076
		p	0.274	0.313	0.690
	Weight	r	0.257	0.467	0.272
		p	0.171	0.009*	0.145
	BMI	r	0.140	0.422	0.167
		p	0.459	0.020*	0.377
Female	Age	r	0.269	0.214	-0.009
		p	0.193	0.304	0.968
	Height	r	0.274	0.016	-0.167
		p	0.185	0.940	0.426
	Weight	r	-0.039	0.108	0.005
		p	0.853	0.609	0.982
	BMI	r	-0.119	0.072	0.087
		p	0.571	0.731	0.678
All Groups	Age	r	-0.002	0.121	0.017
		p	0.990	0.381	0.902
	Height	r	0.564	0.307	0.192
		p	0.000*	0.023*	0.160
	Weight	r	0.527	0.482	0.287
		p	0.000*	0.000*	0.033*
	BMI	r	0.296	0.459	0.260
		p	0.028*	0.000*	0.055

\* $P < 0.05$  statistically significant

Table 4. Spearman Rho correlation analysis results between the groups' age, height, weight and BMI variables and left foot variables

Groups	Variables	Statistics	Muscle Strength Average	Achilles Tendon Thickness	Plantar Fascia Thickness
Male	Age	r	0.102	-0.057	0.131
		p	0.591	0.765	0.490
	Height	r	0.316	0.173	0.208
		p	0.089	0.362	0.269
	Weight	r	0.311	0.581	0.289
		p	0.094	0.001*	0.121
BMI	r	0.136	0.590	0.176	
	p	0.472	0.001*	0.353	
Female	Age	r	0.141	-0.105	0.019
		p	0.502	0.617	0.927
	Height	r	0.260	-0.275	0.172
		p	0.209	0.183	0.410
	Weight	r	0.002	0.239	0.163
		p	0.993	0.250	0.436
BMI	r	-0.058	0.264	0.059	
	p	0.784	0.201	0.778	
All Groups	Age	r	0.035	-0.123	0.029
		p	0.802	0.370	0.832
	Height	r	0.584	0.191	0.209
		p	0.000*	0.162	0.126
	Weight	r	0.574	0.471	0.248
		p	0.000*	0.000*	0.068
BMI	r	0.324	0.514	0.168	
	p	0.016*	0.000*	0.221	

\*P&lt;0.05 statistically significant

Spearman Rho correlation analysis was conducted on the data to find out the correlation between left foot variables of the participants. A positive moderately strong correlation was found in men between Achilles tendon thickness and plantar fascia thickness ( $p<0.05$ ). A positive moderately strong correlation was found in women between muscle strength average and plantar fascia thickness ( $p<0.05$ ) (Table 6).

Mann-Whitney U test was conducted on the data to find out

whether there were statistical differences between men and women in terms of the variables of muscle strength average, Achilles tendon thickness and plantar fascia. According to the Mann-Whitney U test, a statistically significant difference was found between men and women concerning muscle strength averages for the right foot, Achilles tendon thickness and plantar fascia thickness ( $p<0.05$ ). Concerning left foot, a statistically significant difference was found only in muscle strength average ( $p<0.05$ ) (Table 7).

**Table 5. Spearman Rho correlation analysis results of the groups' right foot variables**

Groups	Right	Statistics	Muscle Strength Average	Achilles Tendon Thickness	Plantar Fascia Thickness
<b>Male</b>	Muscle Strength Average	r	1.000	0.059	0.136
		p	-	0.758	0.475
	Achilles Tendon Thickness	r	0.059	1.000	0.357
		p	0.758	-	0.053
	Plantar Fascia Thickness	r	0.136	0.357	1.000
		p	0.475	0.053	-
<b>Female</b>	Muscle Strength Average	r	1.000	0.335	0.005
		p	-	0.101	0.982
	Achilles Tendon Thickness	r	0.335	1.000	0.099
		p	0.101	-	0.638
	Plantar Fascia Thickness	r	0.005	0.099	1.000
		p	0.982	0.638	-
<b>All Groups</b>	Muscle Strength Average	r	1.000	0.339	0.300
		p	-	0.011*	0.026*
	Achilles Tendon Thickness	r	0.339	1.000	0.374
		p	0.011*	-	0.005*
	Plantar Fascia Thickness	r	0.300	0.374	1.000
		p	0.026*	0.005*	-

\*P&lt;0.05 statistically significant

**Table 6. Spearman Rho correlation analysis results of the groups' left foot variables**

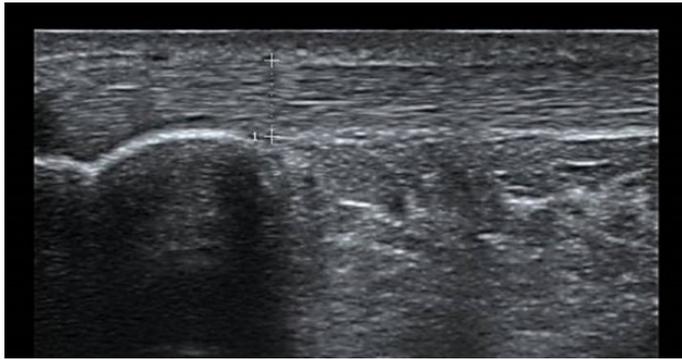
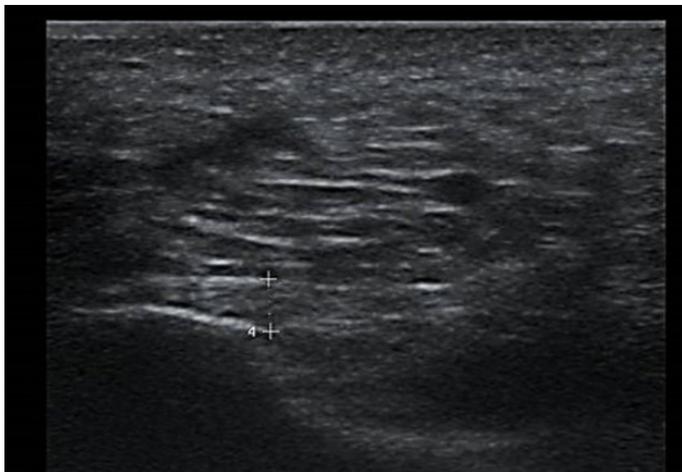
Groups	Right	Statistics	Muscle Strength Average	Achilles Tendon Thickness	Plantar Fascia Thickness
<b>Male</b>	Muscle Strength Average	r	1.000	0.059	0.136
		p	-	0.758	0.475
	Achilles Tendon Thickness	r	0.059	1.000	0.357
		p	0.758	-	0.053
	Plantar Fascia Thickness	r	0.136	0.357	1.000
		p	0.475	0.053	-
<b>Female</b>	Muscle Strength Average	r	1.000	0.335	0.005
		p	-	0.101	0.982
	Achilles Tendon Thickness	r	0.335	1.000	0.099
		p	0.101	-	0.638
	Plantar Fascia Thickness	r	0.005	0.099	1.000
		p	0.982	0.638	-
<b>All Groups</b>	Muscle Strength Average	r	1.000	0.339	0.300
		p	-	0.011*	0.026*
	Achilles Tendon Thickness	r	0.339	1.000	0.374
		p	0.011*	-	0.005*
	Plantar Fascia Thickness	r	0.300	0.374	1.000
		p	0.026*	0.005*	-

\*P&lt;0.05 statistically significant

**Table 7. Assessment of right and left foot variables in terms of gender**

Side	Muscle Strength Average	Achilles Tendon Thickness	Plantar Fascia Thickness
Right	0.000*	0.013*	0.012*
Left	0.000*	0.069	0.113

\*P<0.05 statistically significant

**Figure 1.** Achilles tendon thickness measurement by US**Figure 2.** Plantar fascia thickness measurement by US

## DISCUSSION

Achilles tendon thickness differs concerning ethnic groups and populations. In a study conducted in Holland, average Achilles tendon thickness was reported as 6.8 mm in asymptomatic individuals, while it was published as 9.2 mm in symptomatic groups (23). In a study conducted in Hong Kong, Achilles tendon thickness of individuals in the second, third, fourth, and fifth decades were examined, and no differences were found between them. Average Achilles tendon thickness was found as 5.1 mm (3.8 mm - 6.9 mm) (24). In another study conducted in Denmark, when pre-exercise and post-exercise Achilles tendon thickness were compared, average Achilles tendon thickness was measured as 5 mm. The tendon was reported to be 0.13 mm thicker after acute exercise.

However, this difference was not statistically significant (25). A study conducted between senior athletes in their seventh and eighth decades and sedentary individuals in Finland, while the difference was found in terms of Achilles tendon width, no difference was found between Achilles tendon thickness and average Achilles tendon thickness was measured as 5.7 mm (26). In our study, average Achilles tendon thickness was measured as 4.6 mm (3.2 mm - 6.2 mm) in the right foot and 4.2 mm (2.9 mm - 6.6 mm) in the left foot. In our study, although the statistical difference was found between female and male groups in terms of height, weight and BMI, in the comparison of female and male participants in terms of Achilles tendon thickness, statistically significant difference was found only in the right foot, no statistically significant difference was found between female and male participants in terms of Achilles tendon thickness in the left side (Table 7). While the positive correlation was found in men between weight and BMI and Achilles tendon thickness, when both females and males were assessed as a whole (in both feet), a positive correlation was found between height, weight, and BMI and Achilles tendon thickness.

In one study, the findings showed that the average plantar fascia thickness was about 3.2 mm in the right foot of men, while it was 3.3 mm in the left foot and about 2.8 mm in the right and left foot of women. However, plantar fascia thickness did not have a statistical significance or positive correlation with age, height, weight, and BMI (27). In our study, plantar fascia thickness average was measured as 3.2 mm (1.9 mm - 4.4 mm) in the right foot of women, 2.9 mm (2 mm - 3.6 mm) in the left foot of women; as 3.2 mm (2 mm - 4.6 mm) in the right foot of men and 3 mm (1.8 mm - 3.6 mm) in the left foot of men. When the results were assessed, a statistically significant difference was found in the right foot when plantar fascia thickness was compared between the two genders. Concerning the left foot, no statistically significant difference was found between men's and women's plantar fascia. In a study conducted by Uzel et al. (28), the average thickness of plantar fascia was 3.3 mm and 3.9 mm in women and men, respectively. They showed a mild correlation between plantar fascia thickness and height, weight, and BMI values. However, they did not find a significant difference between athletes and healthy populations concerning plantar fascia thickness. Similarly, no significant difference was found in our study in both male and female groups (in both feet) between plantar fascia thickness and height, weight, and BMI. No correlation was found between Achilles tendon

thickness and height. However, a significant positive relationship was found in men between weight and BMI and Achilles tendon thickness. When all groups (women and men) were assessed (in both feet), a significant positive correlation was found between plantar fascia thickness and weight (Tables 3-4).

When the correlation between Achilles tendon and plantar fascia thickness was analyzed, while a positive correlation was found in the left foot of men, the right foot correlation was not statistically significant. In women, no correlation was found between Achilles tendon and plantar fascia thicknesses in both feet. When all the groups were analyzed, a meaningful positive relationship was found only on the right side (Tables 3-4).

In the studies related to ankle muscle strength measurement in old and young groups with digital hand dynamometer, weakening between 24% and 37% was found in muscle strength (29). In our study, no correlation was found between muscle strength average values and participants' ages. The reason for this is that the age distribution range of the volunteers in the study was less than ten years. This provides more reliable information us in assessing the correlation of plantar fascia thickness and Achilles tendon thickness with muscle strength.

When both genders were compared concerning muscle strength, a significant difference was found in both right and left feet (Table 7). While no significant correlation was found between plantar fascia thickness and Achilles tendon thickness in both feet of women, a strong correlation was found between muscle strength average and plantar fascia in the left foot (Tables 5-6). According to this result, on the side where the plantar fascia is not thick, foot flexion and plantar fascia load are supported by the Achilles tendon.

In our study, no correlation was found between muscle strength average, plantar fascia thickness and Achilles tendon thickness in both feet of men. When all the groups were assessed together, no correlation was found between left foot muscle strength and plantar fascia and Achilles tendon thicknesses. On the other hand, a moderately strong relationship was found between right foot muscle strength and both plantar fascia thickness and Achilles tendon thickness (Tables 5-6).

In the literature review we conducted, we found mostly plantar fascia assessment in plantar fasciitis etiology. Besides, differences in ankle movement angles and lower extremity dorsal muscle groups were examined in individuals doing sport (30). To our knowledge, there are any studies in the literature on the correlation between muscle strength and plantar fascia thickness and Achilles tendon thickness to compare with this study.

## CONCLUSION

In this study, we set out to present the correlation between muscle strength and plantar fascia thickness and Achilles tendon thickness, which is anatomically and

clinically (especially in terms of doctors of orthopedics and physiotherapy) important. We believe that our results can guide both physicians in diagnosis and treatment and anatomists in terms of the literature. Given that there are different results between men and women and even on the right and left sides of the same gender, this can be useful, especially concerning the approaches of clinic physicians towards diagnosis and treatment. For instance, we believe that our study's findings are of the same importance as the importance of knowing the average values of Achilles tendon thickness in the society in cases when tendinitis diagnosis should be made. Also, the present study will be a source for more detailed and practical studies.

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**Conflict of Interest:** *The authors declare that they have no competing interest.*

**Ethical approval:** To conduct this study, ethical approval was obtained from Uşak University Faculty of Medicine Non-Interventional Clinical Research Ethical Board with the decision numbered 83-06.

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