

# The Risk of Sports Activities – The Injuries of the Achilles Tendon in Sportsmen

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## ABSTRACT

*The aim of this study was to determine whether professional sports activities and intensive training practice affect pathological changes of the Achilles tendon. We also aimed to investigate whether these injuries primarily occur earlier or later in life. This was a cross sectional study of 214 athletes and non-athletes between the ages of 17–66. Participants were divided into four groups: 63 active young athletes, 64 young persons not involved in sports, 6 elderly athletes and 58 elderly people who did not participate in intensive athletic activities during their lifetimes. Ultrasound measurements of the Achilles tendon were performed on all participants. All participants also completed a self-administered survey to collect demographic information and data on athletic participation. Data were analyzed using the chi-square test and Fisher's exact test. Overall, those who were active athletes sought medical care more often than those who did not participate regularly in sports. Twenty-seven (33%) of young athletes had some Achilles tendon pathology, compared to 9 (14%) younger non-athletes. A total of 36 (64%) of elderly athletes were diagnosed with Achilles tendon disorders, compared to 15 (26%) of elderly people who were not active in sports. Microtears, acute tendonitis and peritendonitis were associated with younger age. By contrast, calcifications, scar tissue, and partial or complete rupture were only seen in the elderly groups.*

**Key words:** sport overuse, Achilles tendon injuries

## Introduction

Sports related injuries of the Achilles tendon are associated with contusions, overuse, insufficient warm-up, frequent jumping, and constant pushing of the foot. Injuries may also be associated with poor footwear<sup>1</sup>. Repetition microtrauma that occurs with extensive walking or running exacerbates collagen degeneration within the tendon. This results in tendinopathy, with multiple foci of mucoid degeneration leading to microtears. Microtears, in turn, serve as precursors to further injury<sup>2</sup>. Spontaneous rupture has been associated with a number of disorders, including hypercholesterolemia, gout, and other collagen abnormalities<sup>3</sup>.

The Achilles tendon is responsible for the plantar flexion of the foot and must counter the body's weight during walking or running. As such, it is the largest and strongest tendon in the body<sup>4</sup>. The tendon is a confluence

of the individual tendons of the gastrocnemius and soleus muscles. In the ankle, the tendon lies immediately between the skin and subcutaneous tissues. The tendon is distally inserted in the posterior surface of the calcaneus. The retrocalcaneal bursa lies between the tendon and the calcaneus. The subcutaneous bursa may lie between the skin and the tendon vessels and muscles<sup>5,6</sup>. The Achilles tendon is poorly vascularized. A hypovascular region 6 cm proximal to the calcaneal insertion is the site of most partial or complete ruptures<sup>6</sup>. Professional sporting activities have increased in recent years and have led to a rise in the number of sports-related and overuse injuries<sup>7</sup>. Ultrasonography has become an important tool for evaluating the Achilles tendon and for providing the necessary information for patient management and rehabilitation following the sports – related

injury<sup>8</sup>. Although most studies in Croatia have focused on the anthropological determinants and morphological characteristics of young athletes and sportsman, overuse and sport-related injuries have received less attention<sup>9–12</sup>. The aim of the present study was to determine whether professional sports activities, which include everyday training and competitions, increase the number of pathological changes of the Achilles tendon. A secondary aim was to characterize the relationship between pathological change and age.

**Materials and Methods**

This study examined four different groups. The first group consisted of 63 younger active athletes (42 males and 21 females). The second group consisted of 64 examinees (44 males and 20 females), who didn't report intensive sport activities in their lifetimes. Third study group consisted of 56 elderly former athletes (40 males and 16 females). The final, fourth study group consisted of 58 elderly people who didn't report involvement in athletics during their lifetimes (42 males and 16 females).

*Measurements*

Ultrasound imaging was done with participants lying in the prone position with feet

resting over the end of the examination table. The foot was placed in either a neutral position or in slight dorsiflexion to extend the tendon and effectively flatten the scanning surface. In some cases, a stand-off pad was required to eliminate anisotropic effects, particularly in

imaging tendon insertion<sup>13</sup>. Sonography of the Achilles tendon requires a high frequency linear array probe in the 7–13 MHz range. The Achilles tendon appears on ultrasound as an echogenic structure with a fibrillar pattern in the long axis. In the transverse plane, a similar echogenicity is noted. In this plane, the bundles of fascicles that make up the tendon are visualized in cross section; thus the fibrillar pattern seen longitudinally is lost<sup>14</sup>.

*Statistical analysis*

Data were analyzed as frequencies of a specific disorder within a group and chi-square test was used to determine statistical significance where appropriate. In the contingency table with less than five expected cases in a single cell, Fisher's exact test was used. Analysis was performed using the SPSS package, version 12.0.0, with statistical significance set at  $p > 0.05$ .

**Results**

A total of 241 examinees were assessed by ultrasound. Participants were divided in four study groups; young athletes, young people not active in sports, elderly athletes, and elderly people not active in sports, without gender differences among the groups ( $\chi^2 = 1.07, p = 0.586$ ) (Table 1). Young athletes experienced more tendonitis than other groups (Fisher's exact  $p = 0.006$ ). Athletes, both young and old, reported accessing medical care for their injuries more frequently than non-athletes (Fisher's exact  $p < 0.0001$ ), without gender related differences in any group (Table 1).

**TABLE 1**  
CHARACTERISTICS OF THE EXAMINED GROUPS

Groups	Young athletes		Young people not active in sports		Elderly athletes		Elderly people who did not report active sports involvement	
	n = 63		n = 64		n = 56		n = 58	
Age	17–28		18–29		36–68		38–66	
(mean age)	21		23		52		54	
Gender	M	F	M	F	M	F	M	F
	42	21	44	20	40	16	42	16
Football	16				16			
Ice hockey	14				8			
Handball			13				6	
Tennis	12	8			16	10		
Frequency of training (on average)	5 days a week for 4 hours	5 days a week for 3 hours			14yrs/5days a week for 2 hrs	10yrs/4days a week for 2 hrs		
Acute injuries of A. tendon	4	0	0	0	1	0	2	0
Medical treatment	22	16			40	16	12	4

**TABLE 2**  
DISTRIBUTION OF INJURIES ACCORDING TO THE TYPE OF TENDON INJURY

Group	Young athletes		Young people not active in sports		Elderly athletes		Elderly people who did not report active sports involvement	
	M (n=42)	F (n=21)	M (n=44)	F (n=20)	M (n=40)	F (n=16)	M (n=42)	F (n=16)
Type of tendon injury:								
Acute tendonitis	2 (4%)	1 (4.7%)	0	0	1 (4.5%)	1 (6%)	1 (2%)	0
Peritendonitis	3 (7%)	1 (4.7%)	0	0	2 (5%)	0	0	0
Microtears	6 (14%)	4 (19%)	3 (7%)	2 (10%)	0	0	0	0
Focal enlargement	4 (9.5%)	3 (14%)	2 (4.5%)	1 (5%)	4 (10%)	2 (12%)	2 (4.5%)	1 (6%)
Bursitis	2 (4%)	0	1 (2%)	0	1 (4.5%)	1 (6%)	1 (2%)	0
Hyperechoic tendon	0	0	0	0	8 (20%)	3 (18%)	4 (9%)	2 (12%)
Calcification	0	0	0	0	5 (12%)	1 (6%)	3 (7%)	1 (6%)
Scar tissue	0	0	0	0	8 (20%)	4 (24%)	3 (7%)	1 (6%)
Partial rupture	0	0	0	0	3 (5%)	1 (6%)	1 (2%)	0
Complete rupture	0	0	0	0	1 (4.5%)	0	0	0
Other pathologic changes	1 (4.7%)	0	0	0	0	0	0	0
Total	27 (33%)	9 (14%)	36 (64%)			15 (26%)		

The elderly active group reported the greatest number of injuries, followed by the young active group, while young inactive group had the smallest number of diagnosed Achilles tendon injuries (Table 2).

There was no difference in the frequency of microtears ( $\chi^2=1.98$ ,  $p=0.159$ ) or focal enlargement (Fisher's exact  $p=0.110$ ) in young athletes and young non-athletes. Comparison of the elderly groups revealed no significant differences in the focal enlargement (Fisher's exact  $p=0.155$ ), hyperechoic tendon ( $\chi^2=1.94$ ,  $p=0.164$ ), or calcification (Fisher's exact  $p=0.202$ ). Significantly more cases of scar tissue formation, however, were recorded in the group of previously active participants (Fisher's exact  $p=0.018$ ). Remaining samples in both groups were too small for other statistics to be calculated and properly interpreted.

## Discussion and Conclusions

The results of this study indicate that the pathological conditions of the Achilles tendon can be associated with sport activities, especially in the elderly people who were once highly active athletes. We detected clusters of acute and chronic, traumatic and wear-and-tear injuries among the four studied groups. Acute tendonitis and peritendonitis seem to be associated with younger age, and were more common in the athlete groups. Microtears were observed only in the younger groups, were seen in both athlete and non-athlete sub-groups. Microtears appear not to be associated with any particular level of athletic participation and may be labeled a common finding

rather than a sports related injury. The occurrence of focal enlargement was not associated with age or athletic participation.

A second group of tendon disorders could be described as the disorders of the elderly, since we did not detect any cases in the younger groups. These age-related injuries include hyperechoic tendon, calcification, scar tissue, and partial or complete rupture. These disorders could be due in part to the natural, age-dependent loss of elasticity in the Achilles tendon. In the elderly group, we did detect more cases of scar tissue in the active group, suggesting that intensive use of the tendon may lead to permanent injury, loss of functionality, and increased risk of further pathology.

In the presence of chronic tendinopathy, calcifications of the tendon can be easily demonstrated with ultrasound as echogenic, shadowing foci within tendon substance, making the ultrasound very effective in detecting such conditions<sup>15</sup>. Degenerative change on ultrasound is characterized by loss of the normal fibrillar tendon pattern with hypoechoic foci.

Anechoic foci and/or cleavage planes in the tendon represent collagen rupture and partial Tearing<sup>16,17</sup>. Paratendinitis on ultrasound is characterized by fluid and hypoechoic changes in fat triangle deep to the tendon<sup>18–20</sup>.

The results of this study indicate that the Achilles tendon injuries are almost three times more frequent in young athletes than in young people who are not engaged in athletics. The presence of injury also seems to be associated with increased intensity or training frequency. Tendonitis and peritendonitis were the most commonly

observed conditions. Both conditions represent inflammation of the bursa between the tendon and calcaneus bone<sup>21</sup>. Achilles tendon injuries are about 2.5 times more frequent among senior athletes than among senior non-athletes. Most commonly, those in the senior group exhibited scar tissue and calcifications. Such degenerative change can lead to weakness of the tendon and thereby increase the risk of rupture<sup>22,23</sup>.

Most recent studies have focused on partial or complete Achilles tendon rupture<sup>2,8</sup>. We have attempted, here, to examine continued, repetitive stress that could cause asymptomatic injury.

This study has several limitations. First, the study included a relatively small sample size. We were able to observe general differences between groups, but perhaps more subtle differences or associations eluded us due to our small sample size. Secondly the study uses ultrasound to detect injury, rather than a gold standard method of sample collection, such as surgical or histological specimens. Nevertheless, this study suggests that Achilles tendon injury may be more frequent in people who are active in sports, but these pathological changes may take time to fully develop, and occur most often in the elderly. Additional prospective randomized trials with larger sample sizes and full reporting of outcomes are required.

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## RIZIK ŠPORTSKIH AKTIVNOSTI – OZLJEDE AHILOVE TETIVE U ŠPORTAŠA

### SAŽETAK

Cilj istraživanja bio je utvrditi da li športske aktivnosti i intenzivan trening profesionalnih športaša utječu na pojavu patoloških promjena Ahilove tetive, te da li se te promjene javljaju u mladosti ili u starijoj životnoj dobi. Naše istraživanje predstavlja presječnu studiju 214 ispitanika, športaša i nešportaša, u dobi od 17 do 66 godina. Ispitanici su bili podijeljeni u četiri grupe: 63 aktivna mlada športaša, 64 mlade osobe koje se ne bave športom, 56 starijih športaša i 58 starijih osoba koje nisu nikad tijekom života bile uključene u športske aktivnosti. Svim ispitanicima učinjen je ultrazvučni pregled Ahilovih tetiva obostrano. Svi su ispitanici također ispunili upitnike da bi se skupili anamnestički podaci i podaci o športskim aktivnostima. Podaci su analizirani uporabom hi-kvadrat testa i Fischerovog »exact« testa. Ispitanici koji su aktivni športaši češće su koristili medicinske tretmane nego oni koji ne sudjeluju u športskim aktivnostima. Dvadeset i sedam mladih športaša (33%) imalo je patološke promjene Ahilove tetive, u usporedbi s 9 (14%) mladih ne-športaša. Kod trideset i šestoro (64%) starijih športaša bile su dijagnosticirane promjene Ahilove tetive, u usporedbi s 15 (26%) starijih ispitanika koji se nikad nisu bavili športom. Mikrotraume, akutni tendinitis i peritendinitis bili su utvrđeni kod mladih ispitanika. Nasuprot tome, kalcifikati, ožiljne promjene i parcijalne ili potpune rupture utvrđene su kod starijih športaša.