

Review of Prevalence and Mechanism of Achilles Tendon Injury Among Athletes

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ABSTRACT

Background: The relationship between development of Achilles tendon injury and its prevalence among athletes has been identified in many research articles and this studies contributed to the body of knowledge by linking the relationship between them.

Aim: This is review article on the prevalence of Achilles tendon injury among athletes who participated in different sporting activities such as basketball, football, hiking, running, volleyball, tennis e.t.c; to identify a reason for this and also figure out other potentiating factors that contributes itsthods: A careful literature search was made on some scientific search engines like pubMed, EMBase using a very sensitive search strategy on researches made on Achilles tendon injury and careful analysis was done to link the prevalence among certain occupation focusing on athletes.

Results: The reviews show evidence of prevalence of Achilles tendon injury among athletes which can be linked to the intense activities around the tendon in these set of people and also some other potentiating factors such as age, sex, alcohol consumption, duration of activities we're identified.

Introduction

Achilles' tendon is a thick fibrous tissue that serves as insertion of calf muscle on the calcaneus; it also called the calcaneal ligament. This tendon is the toughest and strongest tendon the body. The Achilles tendon is susceptible to many injuries such as rupture [1] and tendonitis because of excessive usage of the tendon. Injury to the tendon is of great medical importance because of the functions played by this tendon in some movement around the ankle such as planterflexion and eversion which are important during walking and also in weight bearing as the tendon plays a key function in the transfer of weight to the ground while standing. Some previous studies has reported of incidence of Achilles tendon injury among athletes engaged in different forms of sport such as football, sprinting, basketball and others [2-5] and also in among different categories of people such as military personnel [6-9]. Reasons for

this may be due to increase activities around the ankles among individuals of this professions thereby leading to increase shear stress on the Achilles tendon resulting mostly into tear injury. This research reviews the prevalence of Achilles tendon injury among athletes and military personnel, looking critically to some associated factors seen in these set of people that predisposes them to this injury.

Methodology

Literature search of articles on reports and incidence of Achilles tendon injury was made on different databases which about 60 articles were collected and about 52 were exclude because they couldn't meet the inclusion criteria. The inclusion criteria include those cases of Achilles tendon injury shouldn't be

secondary to any cause such trauma, osteoarthritis, indicated drugs such as quinolones, congenital or metabolic problems and also the occupation of the subjects must be stated since the research is focused. Some of the articles were discarded because they were duplicate of others or had similar findings to other selected articles. The occupations focusing on athletes engaging in various sporting

activities and prevalence in each article are recorded. The Prisma flow chart showing the analysis of processes of articles selection is shown below.

Results

A total of 60 articles were retrieved from different databases and only 8 articles were eventually used in these studies (Figure 1).

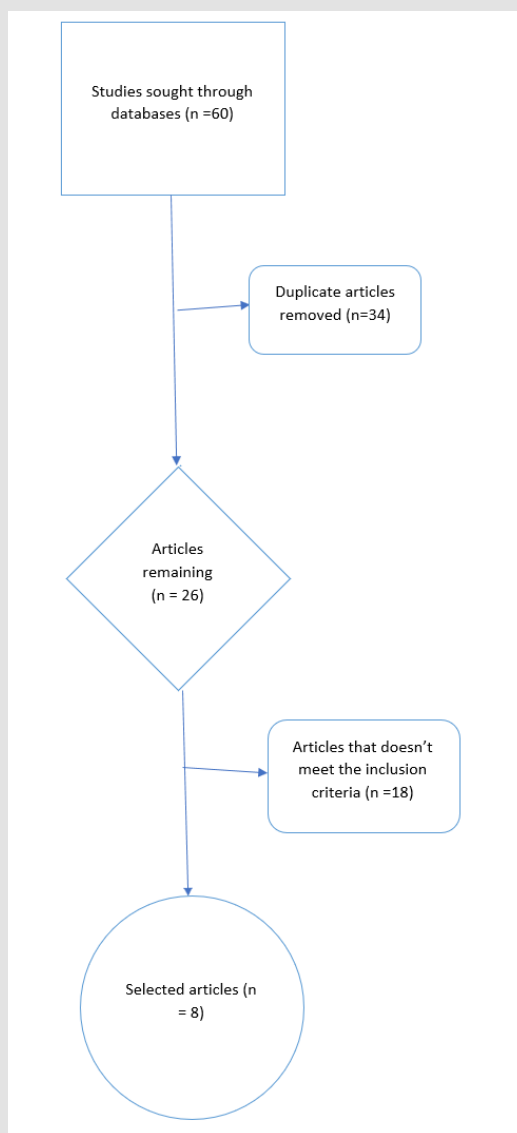


Figure 1: Prisma Flow chart.

Studies on Athletes

In a cross-sectional studies done on 173 athletes reveals that development of Achilles tendon injury in them cannot linked to any identifiable risk factor such as age, sex, height and weight other than that they are athletes who partook in sporting activities which includes track and field athletics [10]. However, the limitation to this study is that athletes with severe Achilles tendon injuries may not

have been included due to the fact that the severity of injury might not have allow them to partook in the track and field events where the study was made. The relationship between age and sporting activity involved among athletes with Achilles’ tendon injury was drafted from research carried out to reveal the epidemiology of Achilles tendon injury in the United States between the year 2012 – 2016 [11]. The observations are recorded in Table 1 below.

Table 1: Showing the prevalence of Achilles tendon injury among athletes with different activities drafted from [11].

Rank	Age (0-19) Sport. n (%)		Age (20-39) Sport. n (%)		Age (40 - 59) Sport. n (%)		Age (60 - 79) Sport. n (%)	
1	Basketball	780(20.0)	Basketball	6838(48.2)	Basketball	3616(30.5)	Tennis	385(17.7)
2	Football	459(11.7)	Soccer	1243(8.4)	SR	1342(11.3)	SR	285(13.1)
3	R/H/S	335(8.6)	Football	1180(8.0)	R/H/S	1218(10.3)	R/H/S	269(12.4)
4	Bicycling	267(6.3)	R/H/S	1072(7.2)	Soccer	952(8.0)	BS	112(5.1)
5	Soccer	260(6.1)	Volleyball	568(3.9)	Tennis	396(3.3)	DR	103(4.7)

Note: *R/H/S = Running/Hiking/Stretching, *SR = Stairs Related, *BS = Ball Sport, *DR = Door Related.

Discussion

The prevalence of Achilles tendon injury seen among athletes [10,11] and military personnel [12] could have resulted from excessive activities around the ankle which resulted to increase tension and shear stress on the tendon leading to either tear of the Achilles tendon or Inflammation (Achilles' tendonitis). Although, some additional risk was identified in some of the articles reviewed such alcohol intake, obesity, age and sex; we considered them as potentiating factors to development of Achilles tendon injury with the major risk being the nature of their occupation which requires increase activities around their ankles. Compared to the general population with the same potentiating factors (age, sex, weight, height) there is increase risk of development of Achilles tendon injury among athletes [12] with basketball being the most associated sporting activities in the United States [11] this may be linked to increase activities such as jumping, bouncing and others that increase the load on Achilles tendon during basketball game professional. There is increase incidence among athletes within ages of 20-39 showing a strong association between age of athletes and development of Achilles tendon injury because athletes within this age bracket are more likely to be doing athletics on full term basis thereby exposing them to longer period of activities.

Mechanism of Injury (Achilles Tendinopathy)

The mechanism of Achilles tendon injury can be described under the following

- a) **Overuse:** Typical Mechanism of Injury: Achilles' tendinitis usually develops from overuse. This can occur with excessive jumping and landing type activities. Repetitive micro traumas due to overload (Compressive or Tensile) cause inflammation of the tendon sheath, degeneration or combination of both. This can lead to tendinopathy It can also occur as a result of trauma such as from a direct blow to the tendon. (Acute rupture).
- b) Decreased arterial blood flow, local hypoxia, decreased metabolic activity, nutrition, and persistent inflammatory response have been suggested as possible factors that

could lead to chronic tendon overuse injuries and tendon degeneration.

Other Contributory Factors to Achilles Tendinopathy

Recent research showed older age, higher android fat mass ratio, and waist circumference > 83cm, in men is associated with a higher chance of having Achilles Tendinopathy [13-15]. The presence of t-The presence of the COL5A1 gene variant was also found to be a possible risk factor. This gene is normally responsible for the production of tendon protein, but patients with the condition were shown to have significantly different allele frequencies of the COL5A1 BstUI RFLP compared with normal subjects [16]. Therefore, besides overuse and degeneration, Achilles Tendinopathy was proposed to have a strong metabolic influence due to poor anatomical vascularity, association with body fat, and the genetic factor. A prospective study identified both female sex and the diminished blood flow response after running as significant risk factors for the development of Achilles tendinopathy [17].

Staging of Injury (The Tendon continuum)

Stages of Tendon Pathophysiology includes

- Reactive tendinopathy
- Tendon disrepair
- Degenerative tendinopathy

Achilles' tendinopathy can be described as an insertional or mid-portion, the difference is in the localization. The insertional form is situated at the level of transition between the Achilles tendon and the bone, the mid-portion form is located at the level of the tendon body [18].

- a) **Reactive Tendon:** 1st stage on the tendon continuum and is a non-inflammatory proliferative response in the cell matrix. This is as a result of compressive or tensile overload. Straining the tendon during physical exercise has been seen as one of the biggest pathological stimuli and systematic overloading of the Achilles tendon above the physiological limit can cause a micro-trauma.

- b) Tendon Disrepair:** The progression of the reactive tendinopathy to TENDON DYSREPAIR can occur if the tendon is not offloaded and allowed to regress back to the normal state. During this phase, there is the continuation of increased protein production which has been shown to result in separation of the collagen and disorganization within the cell matrix. This is the attempt of tendon healing as with the 1st phase but with greater involvement and breakdown physiologically.
- c) Degenerative Tendinopathy:** is the final stage on the continuum and it is suggested that at this stage there is a poor prognosis for the tendon and changes are now irreversible. Often, tendon degeneration is found in combination with peri-tendinous adhesions, but this does not mean that one condition causes the other one.

Sex Differences in Achilles Tendinopathy

The incidence of Achilles tendon rupture has been rising over the past few decades in both men and women, with about 84 percent of cases occurring in men. Some studies have suggested that female hormones like estrogen reduce the risk of rupture in women, but the hormones' precise role has been unclear. In addition, some scientists have argued that the typically larger, stronger calf muscles in men would exert greater forces on the tendon and increase the risk of rupture. To gain a better understanding of the factors influencing sex-specific differences in vulnerability to damage, a team of investigators led by Louis J. Soslowsky, Ph.D., of the University of Pennsylvania, compared the material properties of the Achilles tendon/muscle unit in male and female rats. To specifically test for effects of female sex hormones, they also studied female rats that had been made estrogen-deficient by having their ovaries removed [19]. Their measurements showed that while Achilles tendons from males are larger, those from females are stronger and remain more elastic during movement. They also noted that muscle fibers were larger in male rats compared to females, as expected. These findings suggest that inferior properties of the tendon coupled with greater muscle size could explain men's increased susceptibility to Achilles' tendon ruptures [19].

Conclusion

This research reveals the relationship between being athlete or military personnel and development of Achilles tendon injury as seen in the prevalence of the condition among individuals with these professions.

Conflict of Interest

The authors declared no conflicts of interest.

Acknowledgment

We acknowledged every authors that their works are cited in this review.

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