



## Review

# Hip abductor strength and lower extremity running related injury in distance runners: A systematic review



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## ABSTRACT

**Objectives:** Determine the association between hip abduction strength and lower extremity running related injury in distance runners.

**Design:** Systematic review.

**Methods:** Prospective longitudinal and cross sectional studies that quantified hip abduction strength and provided diagnosis of running related injury in distance runners were included and assessed for quality. Effect size was calculated for between group differences in hip abduction strength.

**Results:** Of the 1841 articles returned in the initial search, 11 studies matched all inclusion criteria. Studies were grouped according to injury: iliotibial band syndrome, patellofemoral pain syndrome, medial tibial stress syndrome, tibial stress fracture, and Achilles tendinopathy, and examined for strength differences between injured and non-injured groups. Meaningful differences were found in the studies examining iliotibial band syndrome. Three of five iliotibial band syndrome articles found weakness in runners with iliotibial band syndrome; two were of strong methodological rigor and both of those found a relationship between weakness and injury. Other results did not form associative or predictive relationships between weakness and injury in distance runners.

**Conclusions:** Hip abduction weakness evaluated by hand held dynamometer may be associated with iliotibial band syndrome in distance runners as suggested by several cross sectional studies but is unclear as a significant factor for the development of patellofemoral pain syndrome, medial tibial stress syndrome, tibial stress fracture or Achilles tendinopathy according to the current literature. Future studies are needed with consistent methodology and inclusion of all distance running populations to determine the significance of hip abduction strength in relationship to lower extremity injury.

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## 1. Introduction

Recent estimates report that of the 45 million runners in the United States, half run at least 50 times per year and many compete in the nearly 30,000 races held annually.<sup>1,2</sup> This vast population of runners is prone to injuries associated with the recurrent stresses of repetitive foot strike.<sup>3</sup> A systematic review comprised of 17 studies and over 11,000 participants found injury rates are between 26 and 92% for distance runners and are most common at the knee (ranging from 7.2 to 50%), the lower leg (9 to 32%), and hip (5.7 to 39%).<sup>4</sup> Many experimental studies have been performed to examine how risk factors, which confound the likelihood of sustaining a running related injury (RRI), may be modified to reduce the occurrence

of injury.<sup>5–9</sup> Resistance training has been touted as a preventative measure and focuses on the lower extremity musculature including hip abductors, which perform a stabilizing function during the running cycle.<sup>10,11</sup>

While many studies examine various factors relating to a particular injury, few studies have examined the association between hip abduction strength and running related lower extremity injuries as a whole. The type of injury and method of measurement are variable between existing studies and no summative reviews have been published. Current research indicates that hip abductors, including the gluteus medius, experience higher activation rates during single leg stability exercises, and recruitment has been observed as delayed or decreased in individuals with patellofemoral pain syndrome (PFPS).<sup>12</sup> Hip abduction strengthening has been observed to improve knee joint kinematics by reducing knee valgus and enhancing patellar tracking, while hip abduction weakness corresponds to altered transverse and frontal plane kinematics in male runners.<sup>11,13,14</sup> However, it is unknown whether hip abductor

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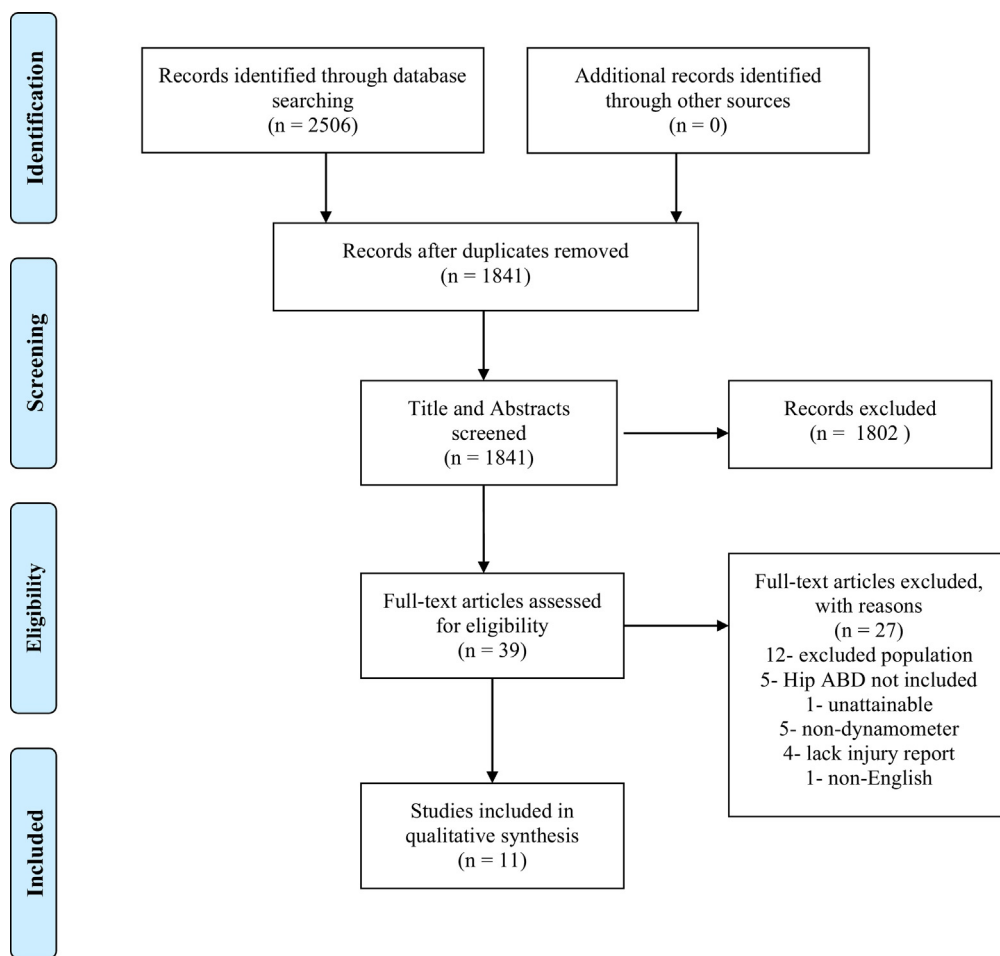


Fig. 1. PRISMA diagram of study inclusion.

strength is a predisposing or associative factor for lower extremity injury in distance runners.

This systematic review aims to gather the available research and describe the association between hip abduction muscle strength and running related lower extremity injury in distance runners. By evaluating the nature of the relationship between hip abduction strength and injury, clinical practice regarding prevention and rehabilitation of patients with RRI may be directed toward the importance of hip abduction muscle strength.

## 2. Methods

Articles included prospective longitudinal studies and cross sectional studies that examined the relationship between hip abductor strength and lower extremity injury in distance runners. Lower extremity was defined as any anatomical structure including and distal to the pelvis. Injury status included any injury of the lower extremity diagnosed by medical professionals or reported by the runner as increased pain level limiting training or competition. Distance runners were defined as individuals at any competitive or recreational level of aerobic endurance running greater than 800 m. Articles were excluded if they included other sport participants, sprinters (competitive events under 800 m) or triathletes. Military studies were also excluded due to the unknown effect of concurrent training. Manuscripts were included that studied any age, gender, experience level, or country of origin, and were also required to report injury criteria, injury status, and dynamometer data. Dynamometer isometric, concentric or eccentric techniques were the only accepted forms of hip abductor muscle measurement, thus

studies using other forms of strength measurement were excluded. Dynamometer measurement has been found to be a reproducible and valid measurement of hip muscle strength.<sup>15,16</sup> Hip abduction is defined as the frontal plane motion at the femoro-acetabular joint that moves the lower extremity away from midline.<sup>17</sup>

Individual electronic search strategies of PubMed, SportsDiscus, CINAHL, SCOPUS, and Web of Science were formulated with assistance from a Walsh University librarian and conducted in December 2015. All searches were formulated under three headings in order to retrieve relevant articles: (1) “Runners or running” as the population studied; (2) “Injury” as one of the outcomes measured; and (3) “Strength” as a primary prognostic measurement or preventative/rehabilitative intervention. Limitations placed on searches varied by database. PubMed was limited to “Human” subjects, SportsDiscus to “Scholarly Articles”, CINAHL to “Scholarly Articles”, SCOPUS to the subject areas of Nursing, Medicine, and Health Professions, and Web of Science to document type Articles or Clinical Trials and the research areas of Sports Sciences, Physiology, Orthopedics, Rehabilitation, or Pathology. No limitations on publication date or study design were placed at this point in the search process. Search strategies as implemented on December 1, 2015 can be found in [Appendix 1](#).

Studies selected for this systematic review followed the process outlined in [Fig. 1](#). Duplicates were removed using EndNote and Google Sheets duplicate removal software. At each screening step, two individuals independently reviewed the obtained titles, abstracts or articles (WC, ES), and where discrepancies occurred, a third member independently reviewed the article for inclusion or exclusion (CW). Full-text articles were screened by two

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