

# IS CORE STABILITY A RISK FACTOR FOR LOWER EXTREMITY INJURIES IN AN ATHLETIC POPULATION? A SYSTEMATIC REVIEW

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## Introduction

**Core stability** has been implied numerous times to influence lower limb functioning. Core musculature provides a stable foundation for safe and controlled movement distal to the core, and is considered as an important contributor in maintaining dynamic joint stability throughout the kinetic chain during locomotion. **It is hypothesized** that impaired core stability increases vulnerability in lower extremity injuries through uncontrolled joint displacements. However, it is unclear how decreased core stability could lead to injuries. Therefore, the **main purpose** of this systematic review is to summarize the literature on the role of core stability as a risk factor in the development of lower extremity injuries.

## Methods

The current review was conducted according to the **Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) statement** (1). Potential eligible studies were identified by consulting 3 databases and were screened for eligibility. Methodological quality across studies was assessed with **Cochrane Collaboration's tool** for assessing risk of bias (**NOS scale**) and level of evidence was determined using the classification system of the **Dutch Institute for Healthcare Improvement CBO** (2).

## Results

Nine articles with low risk of bias were included in the systematic review. Various aspects of core stability were found to be related to lower extremity musculoskeletal injuries in healthy athletic populations. **Core strength** and **core strength imbalance** is found to be a risk factor for ACL-injuries. **Core proprioception** is a risk factor for knee injuries in female collegiate athletes and **neuromuscular control of the core**, measured by displacements of the trunk during movement was also found to be a risk factor in the development of general lower extremity injuries. On the other hand, there was conflicting evidence for endurance of the core musculature as being considered a risk factor for lower extremity injuries.

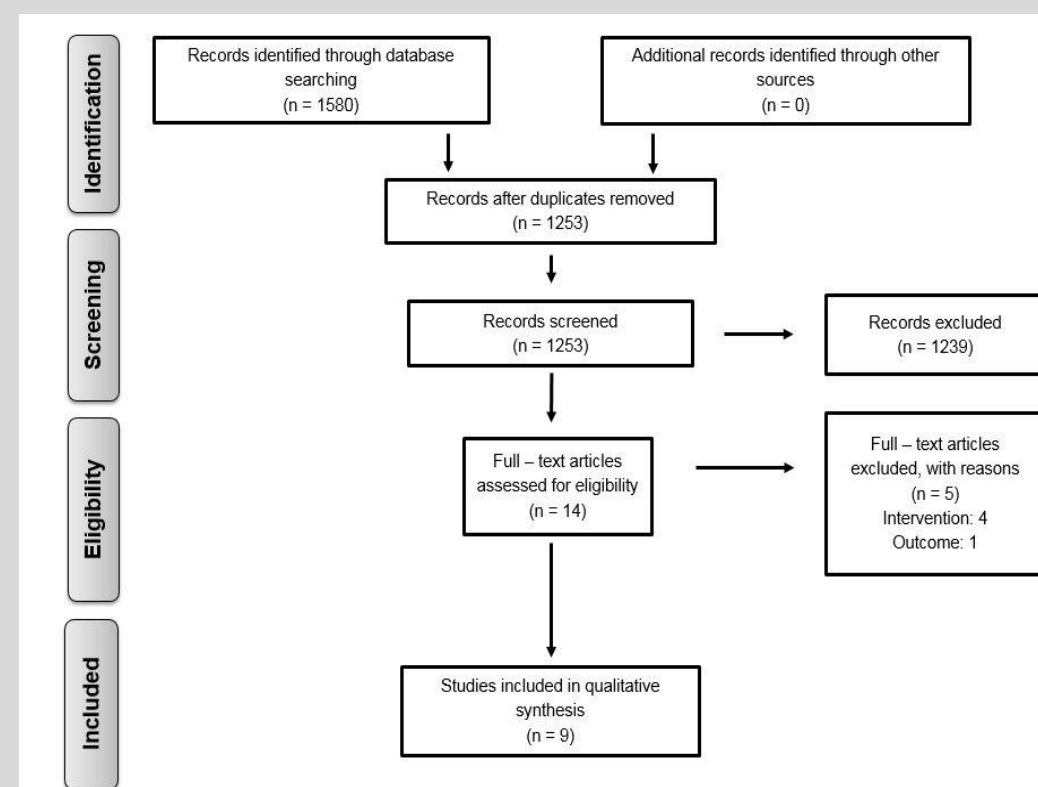


Figure 1: Flowchart of the conducted search

## Discussion

A small amount of studies was available, which furthermore exhibited small study samples and there was significant heterogeneity among the studies. Therefore, it was difficult to formulate a straightforward conclusion. However, when studying the results of this systematic review, a distinct trend can be noticed. Independent of which core stability aspect is researched, the results of these studies suggest that kinematic changes occurring with core dysfunction support a pathomechanical model of femoral adduction and internal hip rotation with an adducted knee position and excessive knee valgus movement during single leg weightbearing activities.

Core stability aspect	Studies	Evidence
Core strength	Raschner et al. (2012)	Preliminary evidence for core strength as a risk factor for ACL-injuries
	Zazulak et al. (2007)a	Preliminary evidence for core proprioception as a risk factor for knee injuries
Core neuromuscular control	Verrelst et al. (2013)	Moderate evidence exists for increased trunk displacement in collegiate athletes who develop general lower extremity injuries
	Verrelst et al. (2015)	
	Zazulak et al. (2007)b	
Core endurance	Roussel et al. (2009)	Preliminary evidence for reduced motor control as a risk factor for lower extremity injuries
	Leetun et al. (2004)	Conflicting evidence for core muscle endurance as a risk factor for lower extremity injuries
	Wilkerson et al. (2012)	
Wilkerson et al. (2015)		

Figure 2: Results of the individual studies

	Representativeness of exposed cohort	Selection of the non exposed cohort	Ascertainment of exposure	Outcome of interest not present at start	Comparability of cohorts	Assessment of outcome	Was follow-up long enough for outcomes to occur	Adequacy of follow-up of cohorts
Leetun et al. (2004)	+	/	-	+	/	+	+	+
Raschner et al. (2012)	-	/	+	+	/	+	+	-
Roussel et al. (2009)	-	/	+	-	/	+	-	+
Verrelst et al. (2013)	-	/	+	+	/	+	+	+
Verrelst et al. (2015)	-	/	+	+	/	+	+	-
Wilkerson et al. (2012)	-	/	+	-	/	+	+	+
Wilkerson et al. (2015)	-	/	+	-	/	+	+	+
Zazulak et al. (2007)a	+	/	-	+	/	+	+	-
Zazulak et al. (2007)b	+	/	-	+	/	+	+	-

Figure 3: Quality assessment

## Conclusions

This systematic review provides preliminary evidence for the association between impaired core stability and the development of lower extremity injuries in healthy athletes. Deficits in various aspects of core stability were identified as potential intrinsic risk factors for lower extremity injuries. As such, core stability needs to be considered when screening athletes.

## References

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