

**Background** Lower limb muscle strain is also a common injury in elite volleyball athletes and lead to sport absence. A proper assessment is crucial to understand injury risk and which factors we should modify to prevent it.

**Objective** To identify the contribution of lower limb strength, range of motion (ROM), alignment and functional stability on lower limb muscle strain in elite volleyball athletes.

**Design** Cross-sectional study.

**Setting** One volleyball team facility.

**Patients (or Participants)** Twenty-five male elite volleyball athletes.

**Interventions (or Assessment of Risk Factors)** All data were collected before the beginning of the competitive season. Athletes were aleatory selected in some stations with physiotherapists previously trained to apply the following tests: Shank-forefoot alignment, passive hip internal rotation ROM, Y-Test, hip extensors strength, knee flexors and extensors strength. Injuries were collected from the historic of past seasons.

**Main Outcome Measurements** Injuries were considered when the athlete had any muscle complaint and stayed absent from the sport for at least one training or match sessions.

**Results** 9 muscle strains were found, which represents 41% of all injuries on the team. The regression model revealed that hip extensor strength was associated with muscle strain in elite volleyball athletes ( $F = 8.050$ ;  $r = 0.518$ ;  $R^2 = 0.235$ ;  $p = 0.010$ ). Specifically, weakness of hip extensors increases the chance of lower limb muscle strain in elite volleyball athletes ( $B = -0.250$ ).

**Conclusions** Hip extensor weakness explains 23% of lower limb muscle strains in elite volleyball athletes. Prevention programs should include hip extensor strengthening to decrease the chance of lower limb muscle strain in elite volleyball athletes.

### 340 KINEMATIC RISK FACTORS OF LOWER EXTREMITY OVERUSE INJURIES DURING LANDING TASKS IN A PHYSICALLY ACTIVE POPULATION: A SYSTEMATIC REVIEW AND META-ANALYSIS

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**Background** Lower extremity overuse injuries are common in athletes participating in sports with repeated bouts of landing manoeuvres.

**Objective** To summarise and determine the relationship between kinematic alterations during a landing task and lower extremity overuse injuries in physically active populations.

**Design** Systematic review and meta-analysis considering prospective cohort, cross sectional or case-control study designs.

**Setting** Electronic databases PubMed, Embase, Web of Science, CINAHL, and SPORTDiscus were consulted in February 2020.

**Participants** Articles including an athletic or physically active, healthy population with an overuse injury of the lower extremity.

**Assessment of risk factors** Methodological quality was assessed by a modified Downs and Black checklist.

**Main outcome measurements** The relationship between three-dimensional (3D) landing kinematics in physically active populations and lower extremity overuse injuries.

**Results** Twenty-three studies that investigated 3D landing kinematics in subjects with either patellar tendinopathy (PT), patellofemoral pain (PFP), exertional medial tibial pain (EMTP) or groin overuse injury met the inclusion criteria. Based on this systematic review, there is evidence for decreased knee flexion range of motion (ROM) and increased knee abduction ROM during landing as risk factors for PFP. For PT, risk factors are poorly understood. Furthermore, the meta-analysis demonstrated significantly greater hip adduction at initial contact (IC) ( $p = 0.02$ ), greater knee internal rotation at IC ( $p < 0.001$ ), greater peak knee external rotation ( $p = 0.05$ ) and less ankle dorsiflexion at peak vertical ground reaction force (vGRF) ( $p = 0.05$ ) in subjects with knee overuse injuries compared to healthy controls. There is evidence of increased trunk, hip and knee transversal ROM as risk factors for EMTP. Groin injuries are associated with greater pelvic and hip frontal and transversal plane ROM in the injured group compared to the healthy controls.

**Conclusion** The results of this systematic review and meta-analysis provide preliminary evidence for impaired landing kinematics associated with lower extremity overuse injuries. Excessive frontal and transversal plane movements during landing manoeuvres might increase impact and tensile forces resulting in lower extremity overuse injuries.

### 341 ALTERATIONS IN WHOLE-BODY BIOMECHANICS DURING FAILED AND SUCCESSFUL UNANTICIPATED SINGLE-LEG LANDINGS: IMPLICATIONS FOR INJURY PREVENTION

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**Background** Non-contact knee injuries often occur when a stimulus alters decision-making during the flight phase of a landing task. We developed a novel protocol to study this paradigm.

**Objective** To evaluate biomechanical differences between failed and successful single-leg drop-jump landings requiring in-flight decision-making.

**Design** Cross-sectional study.

**Setting** Controlled laboratory setting.

**Patients (or Participants)** Thirty-two healthy male ( $n = 16$ ;  $15.9 \pm 1.87$  yrs.) and female ( $15.7 \pm 1.7$  yrs.) competitive Ottawa area athletes with no history of musculoskeletal injury affecting functional performance.

**Interventions (or Assessment of Risk Factors)** Participants completed single-leg drop-jump landings from a platform aligned to their tibial plateau. The landing leg (left-right-both) was randomly assigned to the participant on a projector. Landings were categorized as 'successful' or 'failed' (defined as any loss of balance forcing a participant to adjust their base of support during landing).

**Main Outcome Measurements** Whole body kinematics (Vicon) and muscle excitation amplitudes (EMG) were normalized over the preparatory (flight) and reactive (landing) phases of the drop jump. Moving Average Convergence Divergence (MACD) analysed significant variables to identify when the differences began.