included training-related injuries. Different study designs, injury and illness definitions, race distances, and surfaces, made pooling of results difficult. The foot, knee, ankle, and thigh are the most common anatomical sites of TR injury, with lacerations/abrasions, blisters, muscle strains, cramping, and ankle sprains most commonly diagnosed. TR illness involved the gastrointestinal tract (GIT), metabolic and cardiovascular body systems. Symptoms of nausea and vomiting related to GIT distress and dehydration are commonly reported.

Conclusions Injury and illness are common among TRs participating in TR races. Limited evidence is available on training-related injury and illness in TR specific.

Conclusions The patellofemoral sulcus angle and patellar tendon rotation relative to the femur may be the effective anatomical variations in jumper’s knee occurrence.

337 RELATIONSHIP OF PATELLOFEMORAL ANGLES AND TIBIOFEMORAL ROTATIONAL ANGLES WITH JUMPER’S KNEE IN PROFESSIONAL FOLK DANCERS: AN MRI ANALYSIS

1Nesilhan Aksu, 1Veña Atansay, 1İsk Karalok, 1Ayhan Nedim Kara, 2Azmi Hamzaoglu. 1Demıngolu Biliım University Medical Faculty Florence Nightingale Hospital Orthopedics and Traumatology Department, İstanbul, Turkey; 2Demıngolu Biliım University Medical Faculty Florence Nightingale Hospital Radiology Department, İstanbul, Turkey; 3İstanbul Florence Nightingale Hospital Orthopedic and Spine Center, İstanbul, Turkey

Background Professional dancers learn splash and landing techniques throughout their careers starting in childhood and practice it very frequently like basketball, volleyball and soccer. Among the intrinsic factors, anatomical features of the lower extremity were the most studied in the literature.

Objective In this article, we investigated the relationship of tibiofemoral rotational angles and patellofemoral (PF) angles to the development of jumper’s knee in professional folk dancers.

Design Retrospective cohort MRI study.

Setting Professional folk dance group.

Patients (or Participants) 26 professional folk dancers (16 male, 10 female; mean age of 30.69±7.51 years (17 to 46)) group with complaints of knee pain.

Interventions (or Assessment of Risk Factors) PF sulcus angle and Femur-Insall angle were found to be related to Jumper’s knee.

Main Outcome Measurements We examined 26 dancers with complaints of knee pain, and 32 knees of them had magnetic resonance imaging (MRI). We detected 21 jumper’s knees. We measured patellofemoral angles (Patellofemoral sulcus angle, Lateral patellofemoral angle, Patellar tilt angle, Lateral trochlear-inclination angle, Lateral patellar tilt angle, The patellofemoral congruence angle) and tibiofemoral rotational angles (Condylar twist angles, posterior condylary angles, femur-Insall angles, tibia-Insall angles, posterior tibiofemoral angles, Whiteside-PFCL angles) and noted patellar specifics as alta, Baja, Wiberg on MRI’s with and without jumper’s knee to understand if there is any relationship with tendinopathy occurrence in this cohort study.

Results According to logistic regression analysis, PF sulcus angle was found to be related to quadriceps tendinopathy development (p<0.05, odd ratio (OR): 1.24, 95% confidential interval (CI ): 1.03–1.5) and patellar tendinopathy is found to be related to Femur-Insall angle (p<0.05, OR: 1.27, 95% CI: 1.00–1.61).

338 CALCANEAL BONE DENSITY AND BONE STRESS INJURY IN NCAA DIVISION I ATHLETES AND NON-INTERCOLLEGATE ATHLETE COLLEGE STUDENTS

1Jason Bennett, 1Tricia Austin, 2Ann Hayes, 3Mark Reinking, 4Carroll University, Waukesha, USA; 5Saint Louis University, Saint Louis, USA; 6Regis University, Denver, USA

Background There is limited evidence describing the relationship between calcaneal bone mineral density (cBMD) and activity level or lower extremity overuse bone injury (LEOBI).

Objective The purposes of this study were to: 1) compare cBMD of intercollegiate athletes (ICA) and non-intercollegiate athlete (NA) college students, 2) examine the influence of physical activity on cBMD in NA, and 3) determine if there is an association between cBMD and the development of LEOBI.

Design Prospective, cohort study.

Setting NCAA Division I University.

Participants 84 ICA and 103 NA college students.

Assessment ICAs provided injury and menstrual history, were measured for cBMD at the beginning and end of the year, and were followed for occurrence of LEOBI. NA college students provided injury and menstrual history and were measured for cBMD.

Main Outcome Measures Descriptive statistics, statistical analyses of relationships, logistic regression, and t-tests were used in the statistical analyses.

Results Eight ICAs were diagnosed with a LEOBI over the year. There was no difference in initial cBMD between ICAs with and without LEOBI; right (p=.05) and left cBMD (p=.07) were lower in those ICAs with LEOBI at the end of the season. The NAs had significantly lower cBMD and speed of sound (SOS) than the ICAs. There were no significant differences in cBMD and SOS values between the 8 ICAs with LEOBI and the 103 NAs. For the NAs, there was no significant correlation between cBMD and activity, however, age of onset of menstruation and cBMD were found to be significantly correlated (p<.05).

Conclusions cBMD was significantly lower in NAs as compared to ICAs. The ICAs with LEOBI did not have significantly different cBMD than the NAs. The difference in cBMD between ICAs and NAs may be activity related, but differences in cBMD among the NAs was not related to activity level.
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; R²= 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.

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.

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

Camilla De Bleecker, Stefan Vermeulen, Cedric De Blaiser, Tine Willems, Roel De Ridder, Philip Roosen. Department of Rehabilitation Sciences, Faculty of Medicine and Health Sciences, Ghent University, Ghent, Belgium

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.

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

Nicholas Romanchuk, Kenneth Smith, Michael Del Bel, Daniel Benoit. School of Human Kinetics, University of Ottawa, Ottawa, Canada; School of Rehabilitation Sciences, University of Ottawa, Ottawa, Canada; Ottawa Carleton Institute for Biomedical Engineering, Ottawa, Canada

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 ±1.87 yrs) and female (15.7±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.