

**Objective** To assess the impact of acute peripheral fatigue on lower extremity functional and neurocognitive tests.

**Design** Randomized counterbalanced cross-over design.

**Setting** Primary prevention clinical setting.

**Participants** Twenty healthy participants (three females and ten males; age=24±3 years; height=177.5±6.6 cm; weight=73.2±11.3 kg) participated in this study.

**Interventions** Acute peripheral fatigue was induced by a 30 second modified Wingate protocol matched for maximal 30 second power output, while the participants were seated on the bike for 30 seconds during the control task.

**Main Outcome Measurements** The Y-balance test (YBT), reactive balance test (RBT), single leg hop test (SLH) and counter-movement jump (CMJ) were evaluated pre-post intervention.

**Results** ANOVA revealed no interaction effect of time and condition for the YBT. The CMJ & SLH were significantly lower post physical fatigue intervention ( $p < 0.001$ ), together with the SLH being significantly lower compared to control ( $p = 0.027$ ) post fatigue intervention. A significant decrease in RBT accuracy was observed post physical fatigue ( $p = 0.004$ ), with participants performing significantly worse when peripherally fatigued compared to control ( $p < 0.001$ ). No differences were observed when considering the effect of acute peripheral fatigue on visuomotor reaction time in the RBT.

**Conclusions** In a fatigued state, accuracy in response to environmental stimuli decreases, while visuomotor reaction time remains unaffected. SLH and CMJ are also negatively affected by acute peripheral fatigue, although the functional test performance is not primarily determined by peripheral intra-muscular energy resources. Clinicians should consider evaluating injury risk in a fatigued state, together with the evaluation of neurocognitive performance tests.

143

#### MODELLING THE RISK OF SOFT TISSUE NON-CONTACT INJURIES FROM MULTIPLE TRAINING MONITORING DATA SOURCES IN A SHORT TRACK SPEED SKATING ELITE TEAM

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**Background** In short track speed skating, the Canadian national team monitors their athletes throughout the season to adjust training and maximize the amount of time an athlete is at 100%.

**Objective** This study attempts to create a statistical model to predict the injury risk of an athlete based on training monitoring data with a machine learning approach.

**Design** Retrospective observational study.

**Setting** 2018–2019 season.

**Patients (or Participants)** National women's speed skating team.

**Interventions (or Assessment of Risk Factors)** We defined injuries as overuse, subjective, non-traumatic or soft tissues. Multiple variables were measured throughout the season and pooled in 5 categories: external and internal load, mental state, heart rate variability and neuromuscular function. We also engineered multiple features from the training load

(moving means and SD) over different time scales, providing time evolution information. The machine learning algorithm try to spot patterns in the variables leading to overuse injury. We tested 5 different algorithms, 4 resampling and used 3 different approaches to deal with Non-available data.

**Main Outcome Measurements** We started with a broader perspective, hence the large number of algorithms, resampling technique and variables used. The different models on 3 performance metrics were evaluated: Sensitivity, Specificity and F-score.

**Results** The Naïves Bayes algorithm model with the over/under resampling technique and the fill approach had the best results out of the 75 different possibilities: F-score: 0.77 (harmonic mean of precision and recall), Sensitivity: 0.81 (true positive rate) and Specificity: 0.72 (true negative rate).

**Conclusions** The common imbalance between the injured and non-injured class in our data set and the amount of non-available data forced us to address these issues in a way that could have led to overfitting. However, this project provides great insight in regard to which variables should be considered when trying to predict injury risk. Also, the framework created throughout this project represent a great starting point for future work.

144

#### IS PROXIMAL STABILITY A RISK FACTOR FOR KNEE INJURIES IN ATHLETIC POPULATIONS? A SYSTEMATIC REVIEW WITH META-ANALYSIS AND BEST-EVIDENCE SYNTHESIS

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**Background** Proximal stability has been proposed as a contributor to athletic knee injuries. However, it is unclear if this is supported by current evidence.

**Objective** Examine the association between proximal stability and future athletic knee injuries

**Design** Systematic review, meta-analysis and best-evidence synthesis.

**Setting** Amateur to elite athletic settings.

**Patients (or Participants)** Healthy athletic populations participating in any sport, performing arts, military or physical education teacher education settings with no restriction on sex, age, or level of competition.

**Interventions (or Assessment of Risk Factors)** Six electronic databases were searched (April 2019) for original research articles. Prospective cohort studies investigating at least one proximal stability variable (lumbopelvic-hip strength, endurance, biomechanics, control, proprioception) for knee injuries in athletic populations were included. Quality of studies was assessed using the Quality in Prognostic Studies (QUIPS) tool. **Main Outcome Measurements** Odds ratio effect measures of association between proximal stability variables and future knee injuries. Data not suitable for meta-analysis were synthesized in a best-evidence synthesis.

**Results** Twenty-one studies met the inclusion criteria, with a high risk of bias found in six studies. Meta-analysis revealed that stronger hip extension and external rotation strength were associated with 34% (OR 0.66, 95% CI 0.45–0.96,

$p < 0.05$ ) and 32% (OR 0.68, 95% CI: 0.53, 0.86,  $p < 0.05$ ) decreased odds of future knee injuries, respectively. Results of best-evidence synthesis found that 10 of 15 proximal stability variables were not associated with future knee injuries.

**Conclusions** Hip extension and external rotation strength are the strongest predictors of future knee injuries. The majority of proximal stability variables included in this review were not associated with knee injuries. This review was limited by heterogeneity of measurement methods, making categorizing them difficult. Future studies should consider larger sample sizes to ensure adequate power, and the use of multivariable and complex systems approaches to account for the multifactorial nature of athletic injuries.

#### 145 CORE STABILITY AS A RISK FACTOR FOR THE DEVELOPMENT OF ACUTE LOWER EXTREMITY INJURIES IN AN ATHLETIC POPULATION: A PROSPECTIVE STUDY

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**Background** Impaired core stability has been suggested to influence lower extremity functioning and might contribute to the development of acute lower extremity injuries. Prospective studies that examine this relationship are currently lacking.

**Objective** The objective of this study was to investigate the role of different components of core stability as risk factors for the development of acute lower extremity injuries.

**Design** A prospective study was set up with a follow-up and injury registration period of 1,5 years. Afterwards, cox regression analyses were performed to identify significant contributors in the development of acute lower extremity injuries.

**Setting** Male and female freshmen students, enrolled in the physical education teacher studies of the University Colleges in Ghent participated in this study. The study was performed at the Ghent Sports Arena.

**Patients (or Participants)** 150 healthy participants enrolled and were excluded if they had a history of lower extremity surgery or if they reported a musculoskeletal injury in the 6 months prior to testing. Eleven participants were excluded which resulted in 139 included participants.

**Interventions (or Assessment of Risk Factors)** Measures for dynamic postural control, isometric core and hip muscle strength, core muscle endurance, core neuromuscular control and proprioception were taken at baseline.

**Main Outcome Measurements** The occurrence of an acute lower extremity injury was the primary study outcome.

**Results** During follow-up, 27 injuries of interest occurred (19%). After multivariate model building, a significant predictive effect was found for a muscle strength imbalance for hip flexion ( $p=0.016$ ). The risk of developing an injury increased with a greater strength imbalance, regardless of sex and other core stability measures.

**Conclusions** This study identified hip strength imbalance as a risk factor for the development of acute lower extremity injuries. Normalizing hip strength imbalance might be beneficial for injury prevention. However, further research is needed to support this claim.

#### 146 PSYCHOLOGICAL DISTRESS AND MALADAPTIVE COPING IN OLYMPIC-LEVEL SWIMMERS FOLLOWING POSTPONEMENT OF THE 2020 OLYMPIC GAMES DUE TO COVID-19

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**Background** Elite-level athletes are vulnerable to psychological distress due to rigorous training and competitive schedules. Psychological screening is a preventative strategy to target athletes at risk for maladaptive coping and psychopathology; however, psychological screening is rarely implemented in elite sport environments.

**Objective** To assess psychological distress (i.e., anxiety, psychological strain, and burnout) and coping behavior in Olympic-level swimmers following a major athletic stressor: postponement of the 2020 Olympics due to COVID-19.

**Design** A retrospective mixed-methods design was used.

**Setting** An online psychological assessment and a follow-up telephone semi-structured interview were completed.

**Participants** Participants ( $n=14$ ) included international swimmers who: achieved a top 10 time; placed in the top 3 in their 2019 national meet; or qualified for the World Championships.

**Assessment of Risk Factors** Anxiety, psychological strain, and burnout were evaluated as risk factors for maladaptive coping.

**Outcome Measurements** Assessment included Generalized Anxiety Disorder-7 (GAD-7), Athlete Psychological Strain Questionnaire (APSQ), and Athletic Burnout Questionnaire (ABQ) scales. Coping behaviors were derived from interview content (available for 12 of the 14 participants).

**Results** Findings (mean  $\pm$  SD) indicated mild anxiety ( $6.29 \pm 4.87$ ) and severe psychological strain ( $22.71 \pm 4.83$ ). Higher psychological strain associated with higher emotional and physical exhaustion—a subscale of the ABQ ( $r = 0.791$ ;  $p = 0.001$ ). A subset of athletes ( $n=5$ ) reported moderate-to-severe anxiety. Most athletes ( $n = 9$ ) practiced maladaptive coping (75%) (e.g., behavioral and mental disengagement); however, maladaptive coping was more frequent in athletes with greater psychological distress.

**Conclusions** Several athletes reported levels of anxiety and psychological strain that, according to APSQ and GAD-7 guidelines, necessitated clinical evaluation. Higher psychological distress coincided with more frequent maladaptive coping. Findings urge implementation of psychological screening in elite athletics to better support athletes' mental health and prevent development of maladaptive coping and psychopathology.

#### 147 ABSTRACT WITHDRAWN

#### 148 PERCEIVED INJURY RISK AMONG ELITE TRACK & FIELD ATHLETES — A QUESTIONNAIRE-BASED STUDY

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