More high-impact non-running physical activity increases the risk of prospective running injury.

Allison H. Gruber[1], Cara M. Masterson[1], Marni G. Wasserman[1], Kellee Harper-Hanigan[2]
[1] Department of Kinesiology, Indiana University Bloomington, Bloomington, IN, USA
[2] College of Mathematics, Sciences, and Health Professions, Lincoln Memorial University, Knoxville, TN, USA
Email: ahgruber@iu.edu

Summary

Non-running physical activity (NRPA) has recently been proposed as a potential mechanism for running-related injury (RRI) development [1]. In a prospective observational cohort study, we found an increased RRI risk in runners who engaged in more high impact NRPA than low impact NRPA. NRPA and gait variables representing internal loading and load management did not interact to affect RRI risk.

Introduction

RRIs are often explained through the lens of musculoskeletal tissue loading with an emphasis on loading from running alone. This approach neglects the loading from NRPA despite activities of daily living and non-running exercise imposing substantial loads on musculoskeletal tissues [2] which could potentially impede tissue remodeling. Considering NRPA in RRI models may address the conflicting findings regarding the gait mechanics associated with RRI [1]. The aim of this study was to examine NRPA type (high- (HI) and low- impact (LI)) as a risk factor for RRI. We further examined the potential for interaction of NRPA with biomechanical variables associated with internal loading (vertical ground reaction force active peak (VAP)) and load management or attenuation (knee stiffness) on RRI risk. Given the beneficial adaptations of musculoskeletal tissues that can occur with greater HI axial loading, we hypothesized that greater HI-NRPA would decrease overall RRI risk and examined the interaction of NRPA with VAP and knee stiffness on RRI risk.

Methods

46 recreational runners (30F/16M; 30.5 ± 13.8 years old; BMI: 22.3 ± 3.2 kg/m^2; years running 6.0 ± 7.8) completed a 12-month prospective observational cohort study with a 3D running gait analysis at enrollment. NRPAs were assessed from a past-year physical activity survey at enrollment and a weekly activity log during follow-up. NRPAs were categorized as HI or LI based on loading magnitude and frequency. The past year and each week of follow-up were categorized as HI or LI based on whether more hours/week and months/year were spent performing HI-NRPAs than LI-NRPAs. Each participant was categorized as high or low VAP and high or low knee stiffness based on a median split for each variable. A Cox proportional hazard model adjusting for age, body mass index, gender, past year NRPA type, previous RRI, and running experience was used to calculate time at risk from enrollment to study completion or week prior to RRI. The model was adjusted separately for dichotomous (high/low) VAP and knee stiffness to examine the individual interaction of these variables and weekly NRPA type on RRI risk.

Results and Discussion

Covariates, running behavior during follow-up, and number of subjects categorized as high or low VAP and knee stiffness did not differ between the injured (n = 21) and uninjured groups (n = 25) (p ≥ 0.06). Contrary to the hypothesis, the adjusted hazard model indicated a significant increase in RRI risk for those who engaged in more weeks of HI- vs. LI-NRPA during follow-up (hazard ratio (HR) = 3.1, 95%CI = 1.2–8.4, p=0.02; Figure 1).

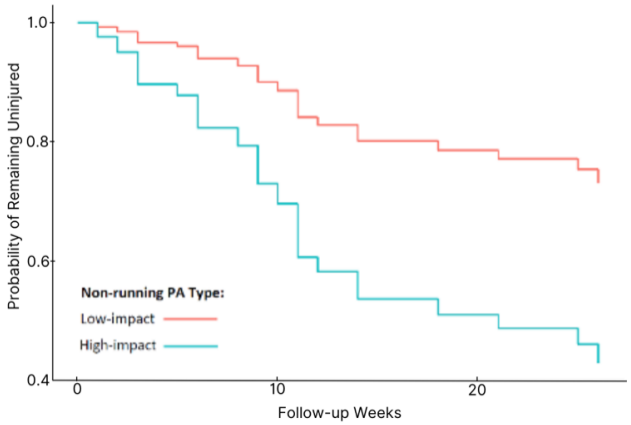

Figure 1: Adjusted model for the effect of NRPA on RRI risk.

Including knee stiffness in the adjusted model did not change the relationship between HI-NRPA and RRI risk (HR = 3.6; 95% CI = 1.1–12.1; p = 0.04). There was no interaction of HI-NRPA and knee stiffness (p = 0.79). When VAP was entered separately into the adjusted model, the association between HI-NRPA and RRI risk became non-significant (HR = 3.14, 95% CI = 0.88–11.27, p = 0.08). The interaction between VAP and HI-NRPA was non-significant (p = 0.89).

Conclusions

Too much HI-NRPA concurrent with running may impede musculoskeletal tissue repair, which emphasizes the need to incorporate rest days within a training schedule. NRPA should be included in future RRI studies given its association with RRI risk and that VAP and knee stiffness were not different between injured and uninjured runners in our previous reports [3,4]. Including NRPA in future RRI studies may help explain conflicting findings regarding gait risk factors for RRI [3,5].

References

[1] Harper-Hanigan & Gruber (2022). *JOSPT*, **52**(11):705-8.
[2] Miller et al. (2015). *Gait Posture*, **41**:326-328.
[3] Davis & Gruber (2021). *Orthop J Sports Med*, 9(5).
[4] Gruber et al. (2016). *ASB Annual Meeting Proceedings.*
[5] Messier et al. (2018). *Am J Sports Med*, 46(9):2211-21.