

A Comparison of Injury Risk Determined by Laboratory and Field Tests

Maren Iverson, Tori Grootwassink, Alex Hanson, Colleen Bouchard,
Mary Stenson, & Don Fischer

College of Saint Benedict/Saint John's University Department of Exercise Science and Sport Studies



Introduction

- College athletic programs commonly use laboratory and field tests to assess athletes' injury risk.
- Larger peak eccentric vertical ground reactions force (GRFv) predicts non-contact anterior cruciate ligament (ACL) injury in female athletes.^{1,2}
- Functional Movement Screen (FMS) has been shown to predict injury in female athletes.³
- Landing Error Scoring System (LESS) is a reliable method of identifying high risk movements¹ but does not predict ACL injuries in high school or college athletes.⁴
- No research has examined the relationship between these measures of injury risk.

Purpose

- The purpose of this study was to determine the relationship between variables measured by three injury risk assessments: LESS, peak eccentric GRFv, and FMS.

Methods

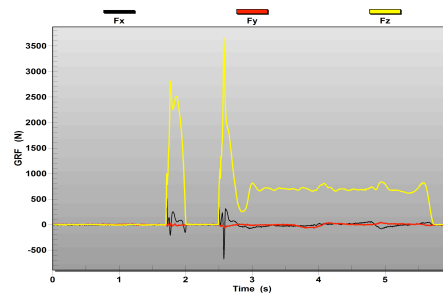
- Seventy-six Division III female athletes (basketball $n = 8$, soccer $n = 25$, cross-country $n = 23$, and volleyball $n = 20$).
- The athletes performed a 10-minute general dynamic warm-up prior to testing.
- Each athlete performed three box drop vertical jump (BDVJ) trials from a 30cm box onto an AccuPower force platform and all BDVJ trials were videotaped. Force plate data were sampled at 400Hz and normalized to body weight.
- The BDVJ that produced the greatest vertical jump height, based on flight time, was used for GRFv and LESS analysis.
- The 17 item LESS was used to qualitatively assess landing and jumping mechanics for each athlete and a composite LESS score was calculated for each leg (maximum possible score = 19), from which a LESS Relative Risk classification was assigned [0 = excellent (LESS ≤ 4), 1 = good (4 < LESS ≤ 5), 2 = moderate (5 < LESS ≤ 6), or 3 = poor (LESS > 6)].¹
- Athletes then performed 7 separate movement tests associated with the FMS. Each test was analyzed and scored using a 3-point scale.⁵ A Composite FMS score was calculated and a FMS injury risk classification was assigned [1 = high risk of injury (FMS score < 14) or 0 = low risk of injury (FMS score > 14)].⁵

Results

Table 1. Bivariate correlations examined the relationships between test variables.

| | | Peak Ecc GRFv | LESS Risk Left | LESS Risk Right | FMS |
|-----------------|---------|---------------|----------------|-----------------|-----|
| Peak Ecc GRFv | Pearson | 1 | | | |
| | N | 76 | | | |
| LESS Risk Left | Pearson | .318* | 1 | | |
| | N | 76 | 76 | | |
| LESS Risk Right | Pearson | .284** | .880** | 1 | |
| | N | 76 | 76 | 76 | |
| FMS Risk | Pearson | -.229* | .122 | .018 | 1 |
| | N | 76 | 76 | 76 | 76 |

* Indicates significant results ($p < 0.05$), ** indicates significant results ($p < 0.01$)



Graph 1. GRFv Example.

Discussion

- The significant positive correlation with LESS and peak eccentric GRFv suggest the two tests measured similar or related risk factors.
- Since, peak eccentric GRFv has been shown to predict non-contact ACL injury risk¹, the significant correlation with the LESS may provide evidence of a modest criterion-related validity for the LESS in predicting ACL injury risk.
- The lack of significant correlation between FMS and LESS suggests that these tests can complement one another for a more comprehensive injury risk assessment than either test alone.

Future Research

- Future research should compare the ability of the FMS, LESS and peak eccentric GRFv to predict injuries, particularly ACL injuries, in isolation or in combination.
- Future research should continue to establish criterion-related validity of the peak eccentric GRFv in regard to the LESS.

Conclusion

- LESS and peak eccentric GRFv may assess similar or related injury risk factors.
- LESS and FMS appear to have little or no overlap in injury risk factor assessment.
- FMS and peak eccentric GRFv appear to assess distinctly different injury risk factors.

References

- Padua, D. A., Marshall, S. W., Boling, M. C., Thigpen, C. A., Garrett, W. E. & Beutle, A. I. (2009). The landing error scoring system (LESS) is a valid and reliable clinical assessment tool of jump-landing biomechanics: The JUMP-ACL Study. *The American Journal of Sports Medicine*, 37(10), 1196-2002. Doi: 10.1177/0363546509343200.
- Hewett, T., Myer, G. D., Ford, K. R. & Slauterbeck, J. (2006). Preparticipation physical examination using a box drop vertical jump test in young athletes. *Clinical Journal of Sports Medicine*, 16(4), 298-304.
- Chorba, R. S., Chorba, D. J., Bouillon, L. E., Overmyer, C. A. & Landis, J. A. (2010). Use of a functional movement screening tool to determine injury risk in female collegiate athletes. *North American Journal of Sports Physical Therapy*, 5(2), 47-54.
- Smith, H. C., Johnson, R. J., Shultz, S. J., Tourville, T., Holterman, L. A., Slauterbeck, J., Vacek, P. M., Beynnon, B.D. (2011). A prospective evaluation of the landing error scoring system (LESS) as a screening tool for anterior cruciate ligament risk. *American Journal of Sports Medicine*, 40(3), 521-526. Doi: 10.1177/0363546511429776.
- Minick, K. I., Kiesel, K. B., Burton, L., Taylor, A., Plisky, P. & Butler, R. J. (2010). Interrater reliability of the functional movement screen. *Journal of Strength and Conditioning*, 24(2), 479-486.

Acknowledgments

- We would like to thank the College of St. Benedict Cross Country, Basketball, Soccer, and Volleyball Teams for their cooperation and participation in our study