



Introduction

- Recreational obstacle course races (OCRs), like the Spartan Race™ and Tough Mudder™, have recently become increasingly popular, with an estimated 500,000 annual participants in the U.S. in 2019.
- OCRs are physically demanding, requiring tasks like running, jumping, climbing, and navigating obstacles.
- Recreational OCRs often mimic military training courses, which are integrated in U.S. military programs like basic training
- The primary purpose of this study was to determine the incidence rate of anterior cruciate ligament (ACL) and associated musculoskeletal (MSK) injuries in recreational and military training OCRs.
- The secondary purpose was to determine if there are any risk factors or features of OCRs impacting the rate of ACL injury in race participants.

Methods

- Studies for this systematic review were identified using the following electronic databases: PubMed, MEDLINE, EMBASE, Cochrane Database, and Scopus.
- Studies meeting the following criteria were included: published in English between 2000-2023, included participants in recreational/military OCRs, categorized injuries relevant to the ACL, knee, or lower extremities, or categorized risk factors for ACL injury in context relevant to OCRs
- Systematic reviews, narrative reviews, and non-peer reviewed studies were excluded.
- Full text was reviewed for all studies that met inclusion criteria.
- Incidence rate (IR) and Male:Female IR ratio (IRR) analyses were performed on data collected.
- Two-tailed t-tests were conducted to assess how the gender influenced IR. Significant findings were determined at a p-value <0.05.

Results

- The initial search identified 2,896 studies, 16 of which met inclusion criteria and were included in the analysis.
- Studies specifically examining ACL injuries in male and female athletes reported a total of 46,892 athlete exposures (AEs), comprising 5,939 female AEs and 40,953 male AEs. Among these, there were 9 ACL injuries in females and 12 in males.
- The total IR of ACL injuries in OCRs was 0.45/1000 ± 0.40 AEs.
- Females had a higher IR than males (1.51/1000 ± 1.42/1000 AEs vs. 0.29/1000 ± 0.23/1000 AEs, IRR=5.14 ± 1.95, P=0.001 (95% CI, 1.23-9.05)).
- Risk factors for ACL injury associated with OCRs included rubber matting terrain and obstacles requiring high impact landings and/or deceleration maneuvers.

Table 1. Female:Male Injury Rate Ratio for Data Extracted on Anterior Cruciate Ligament Injuries & Other Lower Extremity Musculoskeletal Injuries in Obstacle Course Races

| Level | Injury Location | F IR | M IR | F:M IRR | P-value |
|-------------------------------|-----------------|--------------------|--------------------|--------------------|---------------|
| Military | ACL | 6.15 | 0.57 | 10.85 | 0.020 |
| Military | ACL | 0.94 | 0.25 | 3.72 | 0.001 |
| Military | ACL | 1.51 ± 1.42 | 0.29 ± 0.23 | 5.14 ± 1.95 | 0.001 |
| Military | Knee | 13.8 | 10.4 | 1.33 | 0.010 |
| Military | Knee | 14.4 | 10.0 | 1.44 | 0.0011 |
| Amateur | Knee | 0.56 | 0.06 | 10.04 | 0.002 |
| Amateur & Military | Knee | 0.90 ± 0.88 | 0.22 ± 0.19 | 4.03 ± 0.99 | 0.0012 |

Abbreviations: ACL: Anterior Cruciate Ligament. IR: injury rate. F: female. M: male.

Limitations

- Only 2 studies reported specific ACL injury data; most studies listed injuries generally as MSK, lower leg, or knee injuries
- The IR of ACL injuries from data at the U.S. Naval Academy and West Point military academy may not be representative of civilian OCRs, as there is a lack of specific ACL injury data for civilian recreational OCRs.

Conclusion

- OCRs require many high impact pivoting landings, thus presenting a notable risk for ACL and associated MSK injuries.
- The IR of injury is increased in females and on specific terrain (e.g. rubber matting).
- There is an opportunity to investigate biomechanical and physiological differences that increase ACL injury risks in females and to examine how terrain influences injury rates.
- These findings can guide specialized training methods and safer OCR designs.
- The paucity of data on ACL injuries in amateur (non-military) OCRs highlights a need for targeted studies assessing amateur OCR participants, injury rates, and risk factors to enhance safety guidelines for recreational OCR organizations.

References

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