Capability of Fitness Testing to Predict Injury Risk During Initial Tactical Training: A Systematic Review and Meta-Analysis
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A comprehensive literature search within four databases (PubMed, Embase, CINAHL, SPORTDiscus) was performed (Figure 1). The Defense Technical Information Center (DTIC) was also searched after duplicates were removed. The remaining articles were screened for the following inclusion criteria:

- Evaluated one or more measures of physical fitness
- Study included data on training injuries and risk of injury
- Study was observational (e.g., not reporting on an intervention)
- Was peer-reviewed, original research, and published after 1997.

Articles were excluded under the following criteria (Figure 1):

- No fitness measure correlated with injury risk during initial tactical training
- Single event follow-up
- Sporting injury, or
- Heat injury

Crucially, articles were critically appraised to determine the methodological quality by two authors (CT & SS) using the CASP toolkit [6].

Cohen’s kappa coefficient was used to measure the level of agreement and was calculated by a third author (RO).

Studies were selected for meta-analysis based on the following criteria:

- Study investigated a timed running event and injury risk
- Data were reported categorically with a referent risk ratio
- A random-effects model was used to account for differences in tactical subpopulations, different run lengths and varied sample sizes (Figure 2)

To account for differences in categorization (quartile, quintile, half), only the fastest and slowest group from each study were included.

Results

- Fitness test results could be used as a reliable means of identifying trainees at greater risk of injury for proactive intervention but further research specific to the training environment is needed.

- Potential differences in findings may be due training environmental specificity where those training environments which perform a high amount of running may find running as a predictor as opposed to those training environments who do not.

- Direct physiological testing of VO2max as performed by Knapik et al. [7] agrees with the meta-analysis results indicating metabolic fitness is key in mitigating injury risk during tactical training.

- Mean CASP score was 10.6/12 (range 9-12).

- Tactical personnel may benefit from the meta-analysis results indicating metabolic fitness is key in mitigating injury risk during tactical training.

- Studies by sex: n=11 included both male and female trainees, n=8 males only; n=5 females only

- Studies by fitness measure: n=21 investigated a measure of aerobic fitness, n=11 investigated a pushup test, n=10 investigated a situp test, n=3 investigated a chinup or pullup test, n=3 investigated a true strength measure

- Studies by injuries: n=11 reported on any musculoskeletal injury, n=7 examined lower limb stress fractures specifically, n=2 reported on any injury, n=2 reported any musculoskeletal injury requiring hospitalization, n=1 examined time-loss injuries, n=1 reported any lower limb injury

- Meta-analysis indicates that slower run times are unequivocally associated with a substantially higher risk of injury during training: RR 2.27 (CI 1.96-2.63).

- Three tactical subpopulations were represented: Military, Police, and US Federal Bureau of Investigation

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- Summary

- Risk Ratio IV, Random, 95% CI

- Mean: Average Risk Ratio: 0.750 ± 0.12

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- Potential differences in findings may be due training environmental specificity where those training environments which perform a high amount of running may find running as a predictor as opposed to those training environments who do not.

- Based on the data from this review, tactical organizations may benefit from using fitness testing data to identify personnel in need of intervention to minimize risk of training injury

Key References