

Full Study Protocol

Title of the study

Influence of cardiorespiratory fitness on cognitive performance in soldiers

1. Summary

This study investigates how cardiorespiratory fitness (CRF) modulates the effect of acute maximal exercise on vigilance performance in trained soldiers. Thirty-four healthy male soldiers were classified into high or low CRF groups based on ACSM guidelines, and performed a go/no-go psychomotor vigilance task before and immediately after a maximal treadmill test to exhaustion. Outcomes include reaction time, commission errors, and omission errors.

2. Background and rationale

Previous research has shown that physical fitness is positively associated with cognitive performance, particularly in sustained attention tasks. However, the immediate effects of acute high-intensity exercise vary depending on CRF level, with inconsistent findings. Understanding this relationship is relevant in military settings, where rapid and accurate decision-making is often required after intense physical exertion.

3. Objectives

Primary objective: To determine if CRF level modulates cognitive performance after acute maximal exercise.

Secondary objective: To compare pre- and post-exercise differences in reaction time, commission errors, and omission errors between CRF groups.

4. Study design and methodology

Type of study: Interventional, non-randomised, controlled, within-subject design.

Participants: 34 healthy male soldiers, aged 25–40 years, AMPFT passed, normal or corrected vision, no neurological or musculoskeletal disorders.

Procedure:

Day 1: Familiarisation, heart rate monitoring, shortened cognitive task, maximal treadmill test (Bruce protocol, Oxycon Mobile II), CRF classification.

Day 2 (48 h later): Baseline cognitive task, maximal treadmill test, immediate post-exercise cognitive task.

Instruments: Polar M400 HR monitor, Oxycon Mobile II, H/P Cosmos Quasar treadmill, E-Prime® software, go/no-go psychomotor vigilance task with military rifle.

5. Variables

Independent variables: CRF level (high/low), time (pre/post), task block (1–4).

Dependent variables: Mean reaction time (ms), commission errors (%), omission errors (%).

Covariates: VO₂max, maximal running speed, total running time.

6. Statistical analysis

Normality was assessed using the Shapiro–Wilk test. A repeated-measures ANOVA (block × time × CRF group) was used for RT, CE, and OE. Bonferroni correction was applied for pairwise comparisons. The task cost (post-pre difference) was analysed via MANOVA. Mann–Whitney U test was applied to physiological variables. Spearman's correlation was used to explore associations between task cost and physiological variables. Significance level: $p \leq 0.05$.

7. Ethical considerations

Approved by the Ethics Committee of the University of Valencia (Ref: H1402563451425) on 25/07/2014. Participants provided written informed consent. Procedures complied with the Declaration of Helsinki. Participation was voluntary, with the right to withdraw at any time.

8. Timeline

Month 1: Recruitment and familiarisation

Month 2: Experimental sessions

Month 3: Data processing and analysis

Month 4: Manuscript preparation

9. Dissemination

Results will be published in peer-reviewed journals and presented at relevant conferences. Data will be made available on reasonable request, with full anonymisation.