Ball State University

EXAMINING THE INFLUENCE OF AN 8-WEEK FIREFIGHTER-SPECIFIC INTERVAL TRAINING PROGRAM ON EMERGENCY CALL WORKLOADS

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Background

- Traditional sport-athlete training load models have been utilized to quantify the objective work, or external load, and intrinsic responses to work, or internal load, in firefighters (FFs) (1,4).
- Internal load is higher for FFs with lower aerobic capacities (2,3) and greatest for emergency calls involving fire suppression (4).
- However, the responsiveness of these load measures to training in FFs remains unknown.

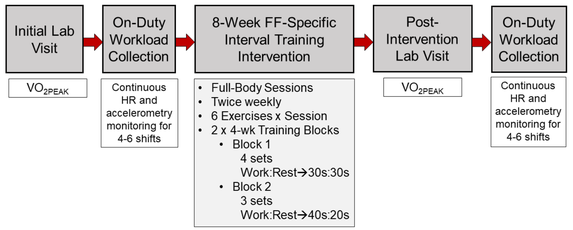
Purpose

- To examine the influence of an 8-wk FF-specific interval training program on cardiovascular fitness and the external and internal load demands of call responses in active-duty FFs.

Methods

Experimental Protocol

- 27 FFs volunteered for this study. Participants were randomly assigned to a control (CTL) or training (TR) group (Table 1).
- Before (T_1) and after (T_2), participants completed a maximal treadmill test to quantify peak aerobic capacity (VO_{2PEAK}) and wore a remote physiological strap that continuously measured acceleration and heart rate (HR) for 4-6 24-h shifts.



- Time-stamped call logs were utilized to post-hoc quantify the external load of each call response as impulse load (IMPULSE), the squared sum of triaxial acceleration scaled to gravity.
- The internal load for each call was quantified as Edward's Training Impulse (ETRIMP), derived from time spent in 5 HR-based intensity zones.
- Calls were categorized as medical (MED), fire without suppression (FIRE0), or fire suppression (FIRE1).
- The IMPULSE and ETRIMP of each call type were averaged for a single observation per participant at T_1 and T_2 and change (Δ) scores were calculated.

Statistical Analyses

- Separate RM ANCOVAs examined for group differences in ΔETRIMP for each call type while controlling for ΔIMPULSE.
- Bivariate Pearson correlations examined for relationships between ΔVO_{2PEAK} and ΔETRIMP for all call types.
- An alpha of $p < 0.05$ determined statistical significance.

Training Intervention

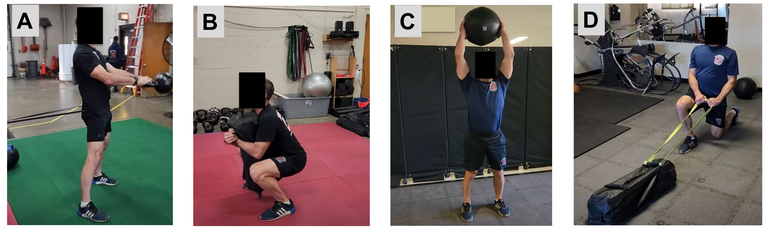


Figure 1. Example FF-specific exercises from training program. **(A)** Banded (hip) kettlebell swing. **(B)** Sandbag bearhug squat. **(C)** Medicine ball slams. **(D)** Reverse lunge with sandbag drag.

Results

	Group	
	Trained	**Control**
Age (yrs)	33.46 ± 7.56	38.5 ± 9.15
Sex	13 male (1 female)	12 male (1 female)
Height (cm)	180.05 ± 5.35	178.57 ± 5.94
Weight (kg)	93.33 ± 12.56	88.51 ± 15.81
ΔVO_{2PEAK} (mL·kg^{-1}· min^{-1})	0.24 ± 2.06	-0.24 ± 2.31

Table 1. Descriptive statistics for training (TR) and control (CTL) groups. Mean ± SD.

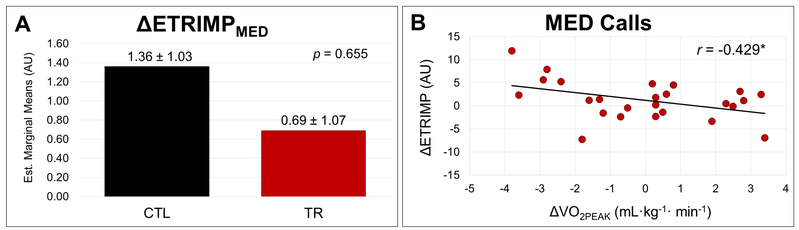


Figure 2. **(A)** A non-significant ($p > 0.05$) difference in $\Delta ETRIMP_{MED}$ was identified between conditions when controlling for external load covariate in model ($\Delta IMPULSE_{MED}$) evaluated at 141.94 N·s. Data are presented as Mean ± SE. **(B)** A significant ($p < 0.05$) negative relationship was identified between $\Delta ETRIMP_{MED}$ and ΔVO_{2PEAK}.

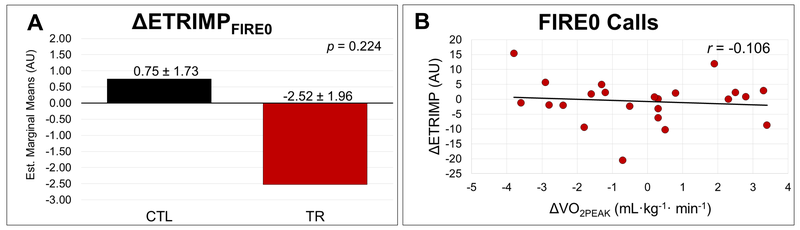


Figure 3. **(A)** A non-significant ($p > 0.05$) difference in $\Delta ETRIMP_{FIRE0}$ was identified between conditions when controlling for external load covariate in model ($\Delta IMPULSE_{FIRE0}$) evaluated at -42.58 N·s. Data are presented as Mean ± SE. **(B)** A non-significant ($p > 0.05$) negative relationship was identified between $\Delta ETRIMP_{FIRE0}$ and ΔVO_{2PEAK}.

Results Cont.

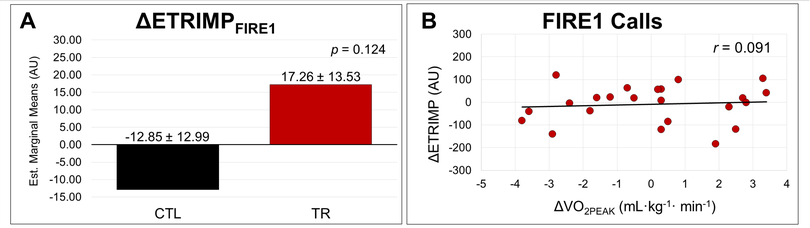


Figure 4. **(A)** A non-significant ($p > 0.05$) difference in $\Delta ETRIMP_{FIRE1}$ was identified between conditions when controlling for external load covariate in model ($\Delta IMPULSE_{FIRE1}$) evaluated at -111.80 N·s. Data are presented as Mean ± SE. **(B)** A non-significant ($p > 0.05$) negative relationship was identified between $\Delta ETRIMP_{FIRE1}$ and ΔVO_{2PEAK}.

Conclusions

- Following the intervention, both groups demonstrated non-significant trends of increased internal load for medical calls.
- However, smaller increases in internal loads were related to greater increases in aerobic capacity.
- For the trained group, non-significant trends of decreased internal load for non-suppression fire calls, and increased load for fire suppression calls, were exhibited and unrelated to aerobic capacity changes.

Practical Applications

- Though an 8-wk interval training program did not significantly influence on-duty emergency call loads, the training group exhibited lower internal load trends for non-fire suppression call responses, suggesting practical enhancements of cardiovascular efficiency for lower intensity work.
- In contrast, the training group demonstrated increased trends in maximal internal load capacity that was unrelated to aerobic capacity.
- Future research should explore the contributions of other physiological systems on maximal workload responses.

Acknowledgements

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References

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