



METABOLIC DIFFERENCES BETWEEN PERSONAL PROTECTIVE EQUIPMENT MODALITIES CARRIED OVER A TREADMILL MARCH

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BACKGROUND & SIGNIFICANCE

- Personal protective equipment (PPE) increases metabolic demands for professionals.
- There are large amounts of information on the metabolic costs of wearing firefighting gear and police PPE, but very limited amounts of research investigating explosive ordinance disposal (EOD) equipment.
- Explosive Ordinance Disposal (EOD) personnel wear a heavier load as personal protective equipment (PPE), and this load is allocated differently than it is for other tactical athletes.
- By investigating the metabolic demands wrought by EOD PPE, Firefighting PPE, and Police PPE, we can make a relative comparison due to the larger volume of research in load carriage concerning fire fighting gear

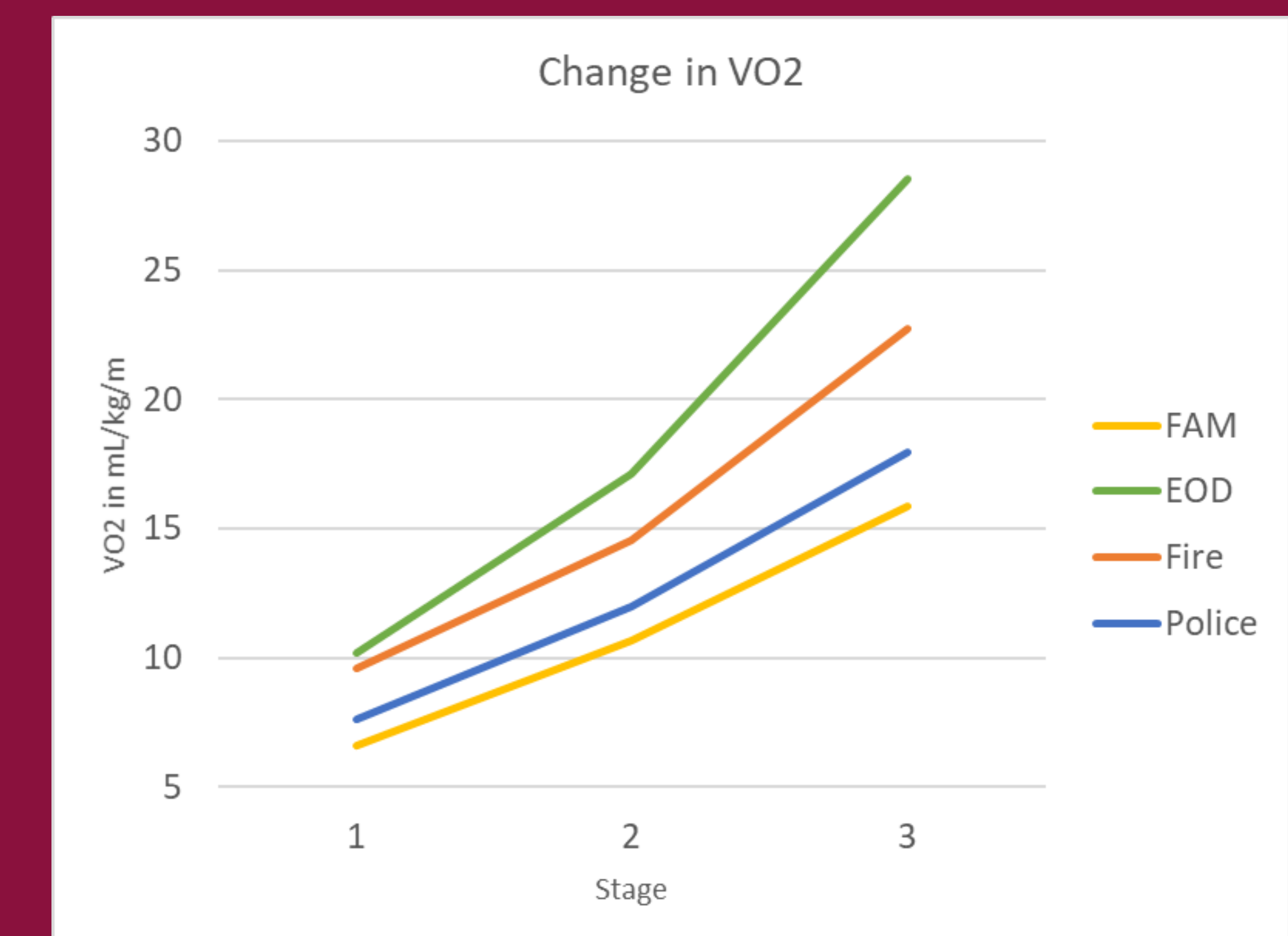
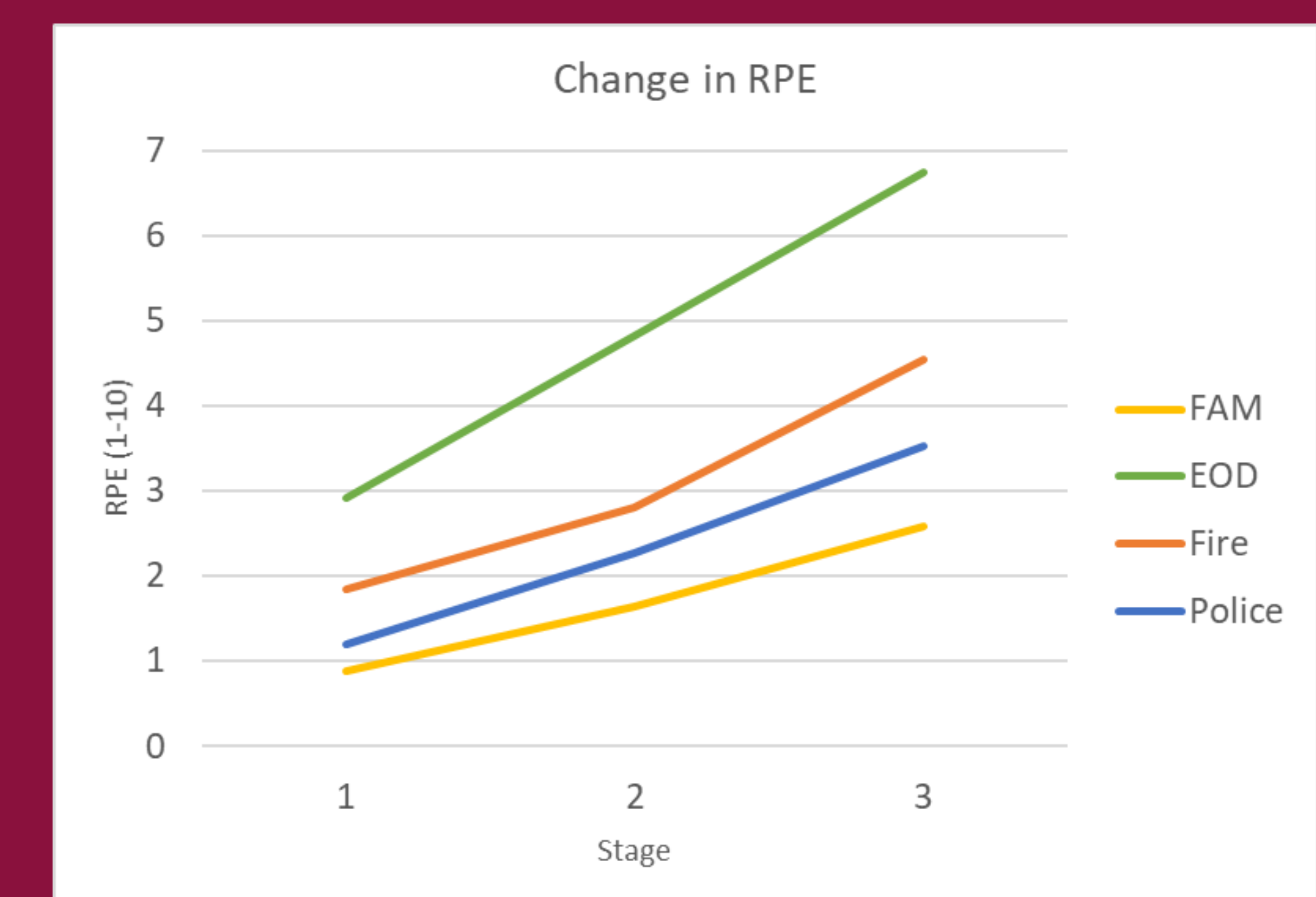
PURPOSE

- To compare metabolic demands of wearing fire fighting personal protective equipment compared to bomb disposal equipment and Police PPE

METHODS

- 10 recreationally trained college aged students (weight 89.8 ± 16.2 kg, age 24.3 ± 5.6 , 3 female, 7 male, height $1.75 \pm .05$ m, (Mean \pm SD)) performed 4 visits in 4 different modalities, including familiarization (FAM), EOD gear (EOD) firefighting gear (Fire), and law enforcement vest and belt (Police)
- During each visit, blood pressure, resting heart rate, body weight, composition (percent body fat (BF%)), and temperature were measured. After these measurements, the PPE was equipped for all visits except FAM.
- Subjects then performed a Bruce treadmill protocol, after which the suit was removed for the loaded visits and the subjects repeated the preliminary testing battery.
- During the FAM visit, subjects completed a standard VO₂ max protocol (Bruce) on the treadmill.
- During the intervention visits, subjects completed a modified Bruce protocol (stage 3).
- Metabolic measurements were recorded during each stage of the test (VO₂, RER, HR).
- Subjects self-reported their ratings of perceived exertion (RPE) during each stage.
- Data was then analyzed for changes in performance between each visit using ANOVA.

Stage	SPEED	INCLINE
1 (3 -min s)	1.7	10%
2	2.5	12%
3	3.4	14%
4	4.2	16%
5	5.0	18%
6	5.5	20%
7	6.0	22%
8	2.5	12% (recovery)



RESULTS

- The EOD suit required significant increases in heart rate (*P< .05) over each stage compared to the FAM visit (ex: Stage 3: FAM 139.3 ± 19.6 , EOD 174.4 ± 8.4 (Mean \pm StdDev)). The Fire suit was likewise more difficult for stages 2 and 3, but the police gear was not significantly different (P<.05)
- VO₂ demands were greater for all stages for the EOD and Fire, but not for the Police (P<.05) (ex: Stage 3: FAM 17.32 ± 2.82 , EOD 27.46 ± 4.49 , Fire 22.91 ± 2.68 , Police 17.75 ± 3.53).
- The EOD and Fire suits also had significant increase in RPE for all stages, while Police did not (P<.05) (ex: FAM 2.58 ± 1.86 , EOD 6.18 ± 2.10 , Fire 3.95 ± 2.54 , Police 3.53 ± 1.60).
- The Police gear was not significantly different (P<.05) from FAM at any stage in terms of HR, VO₂, or RPE, while fire and EOD were different at almost every stage with every metric (Excluding Fire HR at stage 1)

CONCLUSIONS

- Results indicate robust differences in the metabolic cost of wearing EOD and Fire PPE when performing submaximal work.
- The metabolic costs at each stage were consistently higher through both VO₂ and HR for EOD and Fire PPE.
- The RPE was rated higher the entire time for Fire and EOD, but not Police PPE.
- The EOD suit had greater average demand at all stages with all metrics than the Fire suit, save stages 1 and 2 in terms of VO₂.
- More research needs to be conducted concerning EOD load carriage to delineate findings from established fire and police literature

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