ESTIMATED VO2MAX DOES NOT DIFFER BETWEEN FIREFIGHTER GROUP ASSIGNMENTS BASED ON MINUTES PER WEEK OF CARDIOVASCULAR EXERCISE

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Purpose

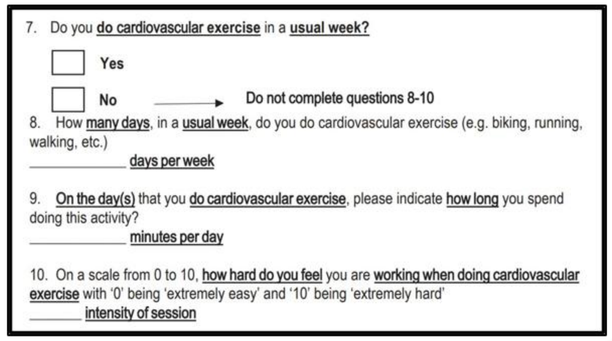
The purpose of this study was to examine if the estimated maximal volume of oxygen consumption (VO2 max) during a Chester Step Test (CST) differs between firefighter group assignments based on self-reported minutes per week of cardiovascular exercise.

Methods

The study was a retrospective analysis of archived data from a medium-sized metropolitan fire department in the southwest United States. The data was collected as part of the fire department's annual fitness assessments and included 86 male career firefighters (37.93±9.23 yrs, 178.93±7.51 cm, 91.33±14.86 kg). As part of their annual fitness assessment, firefighters completed a 4-item questionnaire about their weekly cardiovascular exercise habits including frequency, duration, and intensity of sessions. Firefighters were assigned to 1 of 4 groups based on the number of minutes per week of self-reported cardiovascular exercise: 0-49 minutes, 50-99 minutes, 100-149 minutes, or ≥150 minutes. Each firefighter also completed the CST for their annual fitness assessment.

The CST is a 5-stage step test performed on a 12-inch step. Each stage lasted for 2 minutes. The initial step rate was 15 steps per minute and increased by 5 steps/minute every two minutes. The stepping rate is set by a recorded metronome. The test concluded once a firefighter either completed all five stages or reached 80% of their age-estimated heart rate (HR) maximum. An estimated VO2 max is extrapolated from the subject's maximum HR data points obtained at the end of each stage. An ANCOVA was used to analyze the differences in estimated VO2 max between groups. Exercise intensity was used as a covariate.

Figure 1. Chester Step Test (CST)



7. Do you do cardiovascular exercise in a usual week?
   - ☐ Yes
   - ☐ No → Do not complete questions 8-10
8. How many days, in a usual week, do you do cardiovascular exercise (e.g. biking, running, walking, etc.)
   _____ days per week
9. On the day(s) that you do cardiovascular exercise, please indicate how long you spend doing this activity?
   _____ minutes per day
10. On a scale from 0 to 10, how hard do you feel you are working when doing cardiovascular exercise with '0' being 'extremely easy' and '10' being 'extremely hard'
    _____ intensity of session

Figure 2. sCVE Questionnaire

Results

Group est. VO2 max means and standard deviations are described in Table 1. The ANCOVA revealed that after adjustment for exercise intensity there was not a statistically significant difference in estimated VO2 max between groups, $F(3, 81) = .637$, $p = .593$, partial $\eta^2 = .023$. Cardiovascular exercise intensity was significantly related to estimated VO2 max, $F(1,81) = 9.202$, $p=.003$, $\eta^2 = .102$.

Conclusions

The findings suggest that self-reported weekly minutes of cardiovascular exercise do not appear to be a factor in estimated VO2 max values. The results further suggest that exercise intensity may play a more significant role than cardiovascular exercise minutes per week in cardiovascular health, as indicated by estimated VO2 max values.

Group	N	Mean	SDEV
1	29	40.43	6.09
2	28	42.58	4.25
3	13	40.99	4.78
4	16	43.79	5.64

Table 1. Group est. VO2 max means and standard deviations

Practical Applications

Fire departments should encourage firefighters to maintain a moderate to high-intensity level for the entire duration of cardiovascular exercise sessions in strength and conditioning programs.

References

1. B Le A, McNulty LA, Dyal MA, DeJoy DM, Smith TD. Firefighter Overexertion: A Continuing Problem Found in an Analysis of Non-Fatal Injury Among Career Firefighters. Int J Environ Res Public Health. 2020;17(21):7906.
1. de la Motte SJ, Welsh MM, Castle V, et al. Comparing self-reported physical activity and sedentary time to objective fitness measures in a military cohort. *J Sci Med Sport*. 2019;22(1):59-64.

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