

# Body Fat Percentage and Cardiovascular Exercise Intensity as Predictors of Estimated VO<sub>2</sub> in Firefighters

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## Purpose

This study aimed to examine if a firefighter's age, body composition, and self-reported cardiovascular exercise performed in a usual week predict their estimated volume of oxygen consumption (VO<sub>2</sub>) during a Chester Step Test (CST).

## Methods

The study was a retrospective analysis of archived data from a local fire department's annual fitness assessment. The data included career firefighters (N=86), male (37.93±9.23 yrs, 178.93±7.51 cm, 91.33±14.86 kg) within the data set. As part of their fitness assessment, firefighters completed a 4-item questionnaire about their cardiovascular exercise frequency, duration, and intensity. The body fat percentage was measured using a Tanita TBF-300A scale and body composition analyzer (Tanita Corporation of America, Inc., Arlington Heights, Illinois). Each firefighter also completed the CST. The CST is a 5-stage step test performed on a 12-inch step, with each stage lasting 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 ended

once a firefighter either completed all five stages or reached 80% of their age-estimated heart rate (HR) max. An estimated VO<sub>2</sub> max is extrapolated from the subject's maximum HR data points obtained at the end of each stage. A multiple regression analysis was conducted to explore if self-reported minutes per week and intensity of cardiovascular exercise were predictors of estimated VO<sub>2</sub> max.



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 1.0a: Chester Step Test (CST)  
Figure 1.0b: sCVE questionnaire



Figure 3.0: Tanita TBF-300A scale

## Results

The overall regression model was significant,  $F(4, 81) = 10.838, p < .001$ . The multiple regression analysis revealed that body fat percentage ( $p < .001$ ) and cardiovascular exercise intensity ( $p = .006$ ) were predictors of estimated VO<sub>2</sub>. Age ( $p = .069$ ) and minutes of cardiovascular exercise per week were not significant predictors ( $p = .183$ ).

## Conclusions

The results suggest that body fat percentage and cardiovascular intensity are predictors of cardiovascular fitness in firefighters.

## Practical Applications

Firefighters should focus on maintaining a moderate-to-high intensity level while engaging in cardiovascular activities for a minimum of 300 minutes. This will help increase cardiovascular capacity as well as help in reducing body fat percentage. Firefighters can thereby improve their endurance, work capacity, and overall safety in physically challenging emergency situations, boosting their preparedness.

## Acknowledgements

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## References

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