

Validation of the firefighter WFI treadmill protocol for predicting VO_2 max

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The Wellness-Fitness Initiative submaximal treadmill exercise test (WFI-TM) is recommended by the US National Fire Protection Agency to assess aerobic capacity (VO_2 max) in firefighters. However, predicting VO_2 max from submaximal tests can result in errors leading to erroneous conclusions about fitness.

Aims To investigate the level of agreement between VO_2 max predicted from the WFI-TM against its direct measurement using exhaled gas analysis.

Methods The WFI-TM was performed to volitional fatigue. Differences between estimated VO_2 max (mean \pm SD) and measured VO_2 max (mean \pm SD) were compared (paired t -test, $P < 0.05$). The mean bias and 95% prediction interval (PI) were calculated (Bland-Altman method). The mean bias was -0.9 ml/kg/min (95% PI: -3.1 to 1.3 ml/kg/min) which WFI-TM overestimated VO_2 max.

VO_2 max was 0.9 ml/kg/min with a 95% prediction interval of ± 13.1 . Prediction errors for 22% of subjects were within $\pm 5\%$; 36% had errors greater than or equal to $\pm 15\%$ and 7% had greater than $\pm 30\%$ errors. The correlation between predicted and measured VO_2 max was $r = 0.55$ (standard error of the estimate = 2.8 ml/kg/min).

Conclusions WFI-TM predicts VO_2 max with 11% error. There is a tendency to overestimate aerobic capacity in less fit individuals and to underestimate it in more fit individuals leading to a clustering of values around 42 ml/kg/min, a criterion used by some fire departments to assess fitness for duty.

Key words Firefighters; fitness tests; physical fitness.