

# Validation of the firefighter WFI treadmill protocol for predicting $\text{VO}_2$ 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 ( $\text{VO}_2$  max) in firefighters. However, predicting  $\text{VO}_2$  max from submaximal tests can result in errors leading to erroneous conclusions about fitness.

**Aims** To investigate the level of agreement between  $\text{VO}_2$  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  $\text{VO}_2$  max (mean  $\pm$  SD) and measured  $\text{VO}_2$  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  $-0.1$  ml/kg/min (95% PI:  $-1.1$  to  $0.9$  ml/kg/min) which WFI-TM overestimated  $\text{VO}_2$  max.

$\text{VO}_2$  max was 0.9 ml/kg/min with a 95% prediction interval of  $\pm 13.1$ . 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  $\text{VO}_2$  max was  $r = 0.55$  (standard error of the estimate = 2.8 ml/kg/min).

**Conclusions** WFI-TM predicts  $\text{VO}_2$  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.