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EDITORIAL

Accurately Predicting Cardiorespiratory Fitness

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Aerobic fitness or the maximal aerobic power $(\dot{V}O_{2\max})$ is an important determinant of cardiorespiratory fitness (CRF). The latter is an important component of athletic ability as well as an index of overall health. Consequently, the exercise scientist and the health professional are keenly interested in its measurement. The widely accepted 'gold-standard' measure of $(\dot{V}O_{2\max})$ takes place in a laboratory environment with the measurement of oxygen uptake (using either Douglas bag technology or a breath-by-breath O_2 and CO_2 rapid response analysis system).

While access to a well-equipped laboratory is beyond the reach of the majority of exercise and health practitioners, more readily available assessment tools are field tests. The latter estimates CRF from performance over a set distance(s) or time. The most popular field test used to attain this information is the 20-mSRT (shuttle run test). It is functional, readily understood, and used internationally to provide estimates of cardiorespiratory fitness [1]. Results from the 20-mSRT can also be taken as a marker of an individual's current health status, independent of body fatness, and as a predictor of future health, making it a very useful measure for population health research.

Whilst the absolute results of the 20-mSRT can be easily recorded as laps, stages or total distance attained estimates of CRF (ml kg^{-1} min^{-1}) may vary, depending on the particular predictive equation (of which there are many in the research literature) chosen by the research team. Ever since the late 1980's linear regression equations, usually with the addition of predictor variables such as age, sex, and body mass, were used to estimate or predict cardiorespiratory fitness.

Recently a cross-validation study was made between two predictive equations based on linear regression (one equation used an additional predictor variable [age], the other did not) with a newly developed equation based on multilevel allometric modelling [2]. Estimated $(\dot{V}O_{2\max})$ values for each model were compared with the directly measured maximum values derived from the analysis of expired air: 51.2 ± 8.6 (direct measure) verses 49.8 ± 9.3 (allometric model), 46.8 ±7.9 (linear regression; one predictor) and 44.4 ± 8.6 ml kg^{-1} min^{-1} (linear regression; no additional predictors). There was less bias, and a tighter closeness of fit associated with the allometric model (2.8% error) compared with a percentage error of 9.4 and 14.8% respectively for the linear regression model with one predictor and a linear regression model with no additional predictors [3].

At the level of the individual, the peak VO_2 (absolute or relative to body mass) attained on the 20-mSRT is a true indicator of maximum effort, because the peak VO_2 is achieved at the end of a progressive test which results in volitional exhaustion. As such, the 20-mSRT is used routinely as a preferred alternative where laboratory facilities are not available - to monitor progress (*e.g.* in response to training) due to the low cost of the equipment, and its ability, if appropriate, to test large groups of participants simultaneously.

Consequently, the 20-mSRT could be a useful measure to assess population health and identify 'at-risk' subpopulations. In order to fully characterize an individual for screening and monitoring purposes (in this case a 'health check') the absolute results of the 20-mSRT should be recorded (*e.g.* final stage, fastest shuttle run speed, total distance attained, maximum heart rate) - in addition to an accurate value for

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cardiorespiratory fitness (ml kg^{-1} min^{-1}) derived from a recently published allometric [2].

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