COMPARITIVE VALIDITY OF ICE-SKATING PERFORMANCE TESTS TO ASSESS AEROBIC CAPACITY

by

SUZAN MARY KUISIS

University of Pretoria

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SUMMARY

Comparative Validity of Ice-Skating Performance Tests to Assess Aerobic Capacity

Student: S.M. Kuisis
Supervisor: Dr Johan van Heerden (University of Pretoria)
Co-supervisor: Prof. Luc Léger (University of Montréal)
Department: Department of Biokinetics, Sport, & Leisure Science
Degree: DPHIL (Human Movement Science)

Three multistage aerobic ice skating field tests have recently been introduced: 1) MS20MST (Modified Skating 20 MST; Kuisis, 2003), a maximal continuous multistage stop-and-go test over 20 m; 2) SMAT (Skating Multistage Aerobic Test; Leone et al., 2002), a maximal intermittent multistage shuttle test with stop-and-go over 45 m (both using full ice-hockey equipment); and 3) FAST (Faught Aerobic Skating Test; Petrella et al., 2007), a maximal continuous multistage 160 ft (48.8 m) ice-skating shuttle test with wide turns wearing only gloves, hockey stick and helmet. The aim of the study was to 1) compare the MS20MST, SMAT, and FAST to determine how they relate to each other and to determine their common variance, 2) assess the external and relative validity of the three new practical ice-skating tests to predict maximal aerobic power ($\dot{V}O_2$ max) in adult male hockey players that have mastered their skating skills, using direct treadmill $\dot{V}O_2$ max (“gold standard”) as the criterion variable and predicted $\dot{V}O_2$ max from original equations of the SMAT and FAST (a regression was developed in this study to predict $\dot{V}O_2$ max for the MS20MST). Each test was also compared to the 20 MST (Léger et al., 1988; to determine concurrent validity), 3) determine which test is rated by the players as being the best suited and most functional test (using a 7-point Likert Resemblance Scale), and 4) to determine if these on-ice skating tests are in effect better than the over-ground 20 MST.
Twenty-six adult ice-hockey players of various fitness levels but with good skating skills participated in the study. Expectedly, maximal speed increased from MS20MST to SMAT and to FAST protocols but the latter shows lowest Borg RPE, lactate_max and HR_max (p≤0.05, Repeated ANOVA and Tukey test). Similitude with the intensity of a hockey game and suitability as an aerobic test for ice-hockey was also judged lowest by the subjects for the FAST test on a 7 point subjective Likert Resemblance Scale. Compared to treadmill VO_2 max, correlations were 0.74, 0.73, 0.41 and 0.84 for MS20MST, SMAT, FAST and the 20 MST, respectively. Correlations were slightly better with treadmill max speed (0.75, 0.78, 0.53 and 0.94, respectively) due to small but common accuracy problem of VO_2 measure. Thus using the treadmill test as a standard, the FAST is less valid than the two other skating protocols implying that the ice skating protocol that elicits the highest VO_2 max values would be a better standard. Nevertheless lower HR_max and lactate_max values for the FAST do not support that test. Correlations between the MS20MST, SMAT and the 20 MST were approximately 0.7 but lower between these tests and FAST (approximately 0.4). Based on these results, it is recommended to either use MS20MST or SMAT protocols in elite players if ice time is available, alternatively, the 20 MST. Future study is needed to identify which test yields highest VO_2 max values on ice.

**Keywords:** ice-hockey, aerobic power, skating, modified skating 20 MST, SMAT, FAST.
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LIST OF ABREVIATIONS

%  percentage (one part in every hundred)
°/s  degrees per second (measurement of angular velocity)
°C  degree Celsius (measurement of temperature)

20 MST  20 Metre Multistage Shuttle Run Test (field test that predicts maximal oxygen consumption)

MS20MST  Modified (Skating) 20 Metre Shuttle Test

ft  foot (linear measurement of distance)

FAST  Faught Aerobic Skating Test

g  gram (unit of mass)

HR  heart rate (measured in beats per minute)

HR max  maximal heart rate (measured in beats per minute)

kg  kilograms (unit of mass)

km h⁻¹  kilometres per hour (unit of speed or velocity)

cm  centimetre (linear measurement of distance)

m  metre (linear measurement of distance)

min  minutes (unit of time)

m min⁻¹  metres per minute (unit of speed or velocity)

m s⁻¹  metres per second (unit of speed or velocity)

m min⁻¹  metres per minute (unit of speed or velocity)

MET  metabolic equivalent (a way of expressing energy cost of an activity; a standard quantity of oxygen required for maintenance of life, on a per kilogram body weight basis, per minute under quiet
resting conditions; as a standard value it is equal to 3.5 millilitres of oxygen per minute

- **ml**: millilitre (unit of volume or capacity)
- **ml kg\(^{-1}\) min\(^{-1}\)**: millilitre per kilogram of body mass per minute (unit of oxygen consumption)
- **mmHg**: millimetres mercury (unit of measure of barometric pressure)
- **mmol L\(^{-1}\)**: millimole per litre (unit of molecular weight of a substance; unit of measurement of blood lactic acid)
- **m h\(^{-1}\)**: miles per hour (unit of speed or velocity)
- **n**: number of participants in a group
- **NHL**: National Hockey League
- **O\(_2\)**: oxygen
- **pH**: negative decimal logarithm of hydrogen-ion concentration in moles per litre, giving measures of acidity or alkalinity of a solution
- **r**: correlation
- **r\(^2\)**: coefficient of determination
- **RSS**: Reed Repeat Sprint Skate Test (requires players to skate 55 m six times every 30 seconds)
- **s**: seconds (unit of time)
- **SAS\(_{40}\)**: Sargeant Anaerobic Skate Test (consists of players skating back and forth along pylons placed at a distance of 55 m on the ice for a total of 40 seconds)
- **SD**: standard deviation (the number by which scores deviate from the mean)
- **SEE**: standard error of the estimate (also called standard error of prediction), the amount of error expected in a prediction
- **SMAT**: Skating Multistage Aerobic Test
- **STPD**: the volume of gas expired under standard conditions of temperature (0 °C), pressure (760 mmHg), and dry (no water vapour)
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<th>United States of America</th>
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<td><strong>VE</strong></td>
<td>minute ventilation (the amount of air expired in one minute)</td>
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<td>$\dot{V}O_2$</td>
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<td>maximal oxygen consumption (measured in litres per minute or as millilitres per kilogram per minute); expressed in text as $\dot{V}O_2\text{ max}$</td>
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<tr>
<td>$W\text{ kg}^{-1}$</td>
<td>watt per kilogram (unit of power)</td>
</tr>
<tr>
<td><strong>yr</strong></td>
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