

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

by

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## SUMMARY

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

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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<sub>max</sub> and HR<sub>max</sub> ( $p \leq 0.05$ , 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  $\dot{V}O_2$  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  $\dot{V}O_2$  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  $\dot{V}O_2$  max values would be a better standard. Nevertheless lower HR<sub>max</sub> and lactate<sub>max</sub> 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  $\dot{V}O_2$  max values on ice.

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

## TABLE OF CONTENTS

	Page No.
<b>TITLE PAGE</b>	<b>i</b>
<b>ACKNOWLEDGEMENTS</b>	<b>ii</b>
<b>SUMMARY</b>	<b>iv</b>
<b>TABLE OF CONTENTS</b>	<b>vi</b>
<b>LIST OF TABLES</b>	<b>xii</b>
<b>LIST OF FIGURES</b>	<b>xiii</b>
<b>LIST OF ABBREVIATIONS</b>	<b>xv</b>
<b>CHAPTER 1: INTRODUCTION &amp; AIM</b>	<b>1</b>
1.1. Introduction	1
1.2. Recent Developments in the Field of Ice-Skating	5
1.3. Statement of the Problem	6
1.4. Aim of the Study	8
<b>CHAPTER 2: LITERATURE REVIEW</b>	<b>10</b>
<b>2.1 Locomotion on Ice, Development of Skates, Skating Sport History, and Surface</b>	<b>10</b>
2.1.1 Locomotion on Ice	10
2.1.2 Development of Skates	11
2.1.3 Skating Sport History	13
a) Ice-Hockey	13
b) Figure Skating	16
c) Speed Skating	18
2.1.4 Surface	19



<b>2.2</b>	<b>Basic Rules and Requirements in Ice-Hockey</b>	<b>21</b>
2.2.1	Basic Rules of Ice-Hockey	21
2.2.2	Task Analysis	22
	a) Total Duration of a Game	23
	b) Phases of Play (Stoppages)	23
	c) Distance Skated During a Game	24
	d) Skating Velocity	24
2.2.3	Physical, Muscular, and Metabolic Characteristics and Requirements	26
	a) Physical Characteristics and Requirements	26
	b) Muscular Characteristics and Requirements (Power, Strength, Endurance)	27
	c) Metabolic Characteristics and Requirements (Aerobic and Anaerobic Capacity)	28
	<i>Aerobic Capacity</i>	<i>28</i>
	<i>Anaerobic Capacity</i>	<i>32</i>
<b>2.3</b>	<b>Bioenergetics, Energy cost &amp; Efficiency</b>	<b>36</b>
2.3.1	Energy Cost (Running versus Skating)	36
2.3.2	External Load (Equipment)	38
2.3.3	Drafting	40
2.3.4	Air & Ice Friction	40
2.3.5	Efficiency with Specific Regard to Technique	42
<b>2.4</b>	<b>Aerobic Assessment/ Bioenergetic Aptitude Assessment (Including Aerobic and Anaerobic)</b>	<b>45</b>
2.4.1	Purpose of Testing (Why is it Necessary?)	45
2.4.2	Criteria of a Fitness Test	48
2.4.3	Specificity of Physiological Testing (Laboratory Based vs. Field Tests)	50

2.4.4	Examples of Sport Specific Testing in Other Sports	53
2.4.5	Off-Ice Non Skating Tests	54
a)	Laboratory Treadmill and Cycling Tests (Traditional Modes of Testing)	54
b)	Field Tests	56
	<i>University of Montreal Track Test (UM-TT)</i>	56
	<i>Cooper 12 Minute Test</i>	57
	<i>5 Min Maximal Running Test</i>	57
	<i>40 m Shuttle Running</i>	57
	<i>20 m Multistage Shuttle Run Test (20 MST)</i>	58
	<i>Interval Shuttle Run Test (ISRT)</i>	60
	<i>Modified 5-m Multiple Shuttle Test (5-m MST)</i>	60
	<i>Repeated Sprint Test for Field Hockey</i>	61
2.4.6	Off-Ice Skating Tests	62
a)	Skating Treadmill	62
b)	Slide Board	64
2.4.7	On-Ice Skating Tests	65
	<i>Tests of Speed, Hockey Ability &amp; Anaerobic Capacity</i>	65
	<i>Tests of Aerobic Capacity/ Power</i>	67
2.4.8	Off-Ice Testing <i>versus</i> On-Ice Testing	72
	<b>CHAPTER 3: METHODOLOGY</b>	<b>74</b>
	<b>3.1. Subjects</b>	<b>74</b>
	<b>3.2. Ethical Considerations</b>	<b>76</b>
	<b>3.3. Study Design</b>	<b>76</b>



<b>3.4. Procedures and Instrumentation</b>	<b>77</b>
Biographic Data	77
Physical Data	78
Warm-up and Recovery Procedures	80
Heart Rate	80
Blood Lactate	80
Oxygen Consumption ( $\dot{V}O_2$ )	81
Rating of Perceived Exertion	82
Likert Resemblance Score	82
<b>3.5. Maximal Multistage Laboratory Treadmill Running Test</b>	<b>83</b>
<b>3.6. Field Tests</b>	<b>88</b>
3.6.1. Modified (Skating) 20 MST (MS20MST)	89
3.6.2. Skating Multistage Aerobic Test (SMAT)	91
3.6.3. Faught Aerobic Skating Test (FAST)	94
3.6.4. 20 Metre Multistage Shuttle Run Test	96
<b>3.7. Statistical Analysis and Treatment of Data</b>	<b>98</b>
<b>CHAPTER 4: RESULTS &amp; DISCUSSION</b>	<b>99</b>
<b>4.1 Subject Characteristics and Experimental Conditions</b>	<b>99</b>
<b>4.2 Comparison of Different Variables in All Five Tests</b>	<b>103</b>
4.2.1 Final Speed	105
4.2.2 Duration	106
4.2.3 Maximum Heart Rate	107
4.2.4 Rating of Perceived Exertion	108
4.2.5 Lactate	110

4.2.6	$\dot{V}O_2$ max	111
	<b>Development of the MS20MST Equation</b>	<b>112</b>
<b>4.3</b>	<b>Assessing and Comparing the Validity of Each Test</b>	<b>114</b>
4.3.1	<b>Correlations</b>	<b>114</b>
	<i>Final Speed</i>	<i>114</i>
	<i>Duration</i>	<i>115</i>
	<i>Rating of Perceived Exertion</i>	<i>115</i>
	<i>Lactate</i>	<i>117</i>
	<i>VO<sub>2</sub> max</i>	<i>117</i>
4.3.2	<b>Predictive Validity of Field Tests</b>	<b>118</b>
<b>4.4</b>	<b>Qualitative Analysis: Determining Which Test is Rated by Ice-Hockey Players as Being Best Suited as the Most Functional Using the Likert Scale</b>	<b>124</b>
	<b>Question 1:</b> Similarity of basic skating skills (not puck handling) of the test compared to those of a hockey game	125
	<b>Question 2:</b> Resemblance between maximal intensity of the test & maximal intensity of a hockey game	127
	<b>Question 3:</b> How is the test suited to evaluate aerobic fitness of hockey players?	128
	<b>Question 4:</b> How is the test suited to evaluate overall fitness (including muscular & cardiovascular fitness) of hockey players?	129
	<b>Question 5:</b> How is the test suited to evaluate overall hockey ability (fitness & skating skills) of hockey players?	129
	<b>Correlations Among Q1-5</b>	<b>130</b>

<b>4.5</b>	<b>General Discussion</b>	<b>133</b>
	<i>Final Speed</i>	<i>133</i>
	<i>Heart Rate</i>	<i>134</i>
	<i>Lactate</i>	<i>135</i>
	$\dot{V}O_2 \text{ max}$	<i>136</i>
 <b>CHAPTER 5: CONCLUSIONS &amp; RECOMMENDATIONS</b>		<b>140</b>
	<b>Summary</b>	<b>141</b>
	<b>Conclusions &amp; Recommendations for Practice</b>	<b>142</b>
	<b>Future Research</b>	<b>145</b>
 <b>REFERENCES</b>		<b>146</b>
 <b>APPENDICES</b>		
	Appendix A- Time Motion Analysis of Game Play	
	Appendix B- Physical Characteristics of Ice-Hockey Players	
	Appendix C- Muscular Endurance, Flexibility & Speed Characteristics of Ice-Hockey Players	
	Appendix D- Aerobic & Anaerobic Capacity of Ice-Hockey Players	
	Appendix E- Physical Activity Readiness Questionnaire (PARQ)	
	Appendix F- Letters of Approval from University of Pretoria & University of Montreal Ethical Committees	
	Appendix G- Informed Consent	
	Appendix H- Order of Testing	
	Appendix I- Raw Data Collection Sheet	
	Appendix J- Borg RPE Scale	
	Appendix K- Likert Scale	
	Appendix L- Congress and Manuscript to be submitted for Publication	

## LIST OF TABLES

	<b>Page No.</b>
Table 1.1 Characteristics of the Maximal Multistage Running & Ice-Skating Field Tests to be used in this Study	7
Table 2.1 The Skating Multistage Aerobic Test (SMAT) Maximal Oxygen Consumption Prediction Table for Adult Male Ice-Hockey Players	93
Table 4.1 Subject Characteristics of the Original Sample (n=26)	100
Table 4.2 Subject Characteristics of the Sample Used (n=16)	100
Table 4.3 Regression Summary for Dependent Variable: $\dot{V}O_2$ max (n=21)	113
Table 4.4 Correlations of Maximum (Final) Speed Values	114
Table 4.5 Correlations of Test Duration	115
Table 4.6 Correlations of RPE Values	116
Table 4.7 Correlations of Lactate Values	117
Table 4.8 Correlations of $\dot{V}O_2$ max Values	118
Table 4.9 Correlations and Standard Errors of Estimate Predicting Treadmill $\dot{V}O_2$ max and Maximal Speed from Field Test Maximal Speed	119
Table 4.10 Correlations of Question 1 Values	131
Table 4.11 Correlations of Question 2 Values	131
Table 4.12 Correlations of Question 4 Values	132
Table 4.13 Correlations of Question 5 Values	132

## LIST OF FIGURES

	<b>Page No.</b>
Figure 2.1	Medieval Scene of Ice-Skating by Esaias van de Velde 11
Figure 2.2	Figure, Hockey and Speed Skates 12
Figure 2.3	Figure, Hockey, and Speed Blades 12
Figure 2.4	Ice-Hockey Played at McGill University, Montreal, 1901 14
Figure 2.5	Jaap Eden, the First Official World Champion 19
Figure 2.6	Typical Layout of an Ice-Hockey Rink Surface 20
Figure 3.1	Two Subject Participants and the Researcher 74
Figure 3.2	Subject Participants After the Running 20 MST 75
Figure 3.3	The Frankfort Plane 78
Figure 3.4	A Subject Being Weighed With Full Kit 79
Figure 3.5	Moxus Modular $\dot{V}O_2$ System 81
Figure 3.6	Human Performance Laboratory 83
Figure 3.7	Quinton 65 Treadmill 84
Figure 3.8	Mouthpiece Components 85
Figure 3.9	Mouthpiece Assembly 85
Figure 3.10	Headset 87
Figure 3.11	Subject Participant During a Maximal Treadmill Running Test 87
Figure 3.12	Ice Arena in the CEPSUM 88
Figure 3.13	Ice Layout for Field Tests 88
Figure 3.14	Subject Performing the MS20SMT 90
Figure 3.15	Ice Layout of the Modified (Skating) 20 MST (Kuisis, 2003) 90
Figure 3.16	Ice Layout of the SMAT 92
Figure 3.17	Layout of the FAST 94
Figure 3.18	Indoor Running Track at the CEPSUM 96
Figure 4.1	Comparison of Variables Between Various Tests (n=16) 104
Figure 4.2	Mean Maximal Speed ( $\text{km h}^{-1}$ ) Comparison Between Tests (n=16) 105

Figure 4.3	Mean Test Duration (Min) Comparison Between Tests (n=16)	106
Figure 4.4	Mean Maximal Heart Rate (beats min <sup>-1</sup> ) Comparison Between Tests (n=16)	108
Figure 4.5	Mean Maximal Borg Rating of Perceived Exertion (RPE) Comparison Between Tests (n=16)	108
Figure 4.6	Mean Maximal Lactate (mmol L <sup>-1</sup> ) Comparison Between Tests (n=16)	110
Figure 4.7	Mean maximal $\dot{V}O_2$ max (ml kg <sup>-1</sup> min <sup>-1</sup> ) comparison between tests (n=16)	112
Figure 4.8	Treadmill $\dot{V}O_2$ max as a Function of Speed in the Treadmill Test	118
Figure 4.9	Treadmill $\dot{V}O_2$ max as a Function of Speed in the MS20MST	118
Figure 4.10	Treadmill $\dot{V}O_2$ max as a Function of Speed in the SMAT	119
Figure 4.11	Treadmill $\dot{V}O_2$ max as a Function of Speed in the FAST	119
Figure 4.12	Treadmill $\dot{V}O_2$ max as a Function of Speed in the 20 MST	119
Figure 4.13	Comparison of Treadmill Speed as a Function of $\dot{V}O_2$ max in All Tests	123
Figure 4.14	Comparison of Scores Obtained on the Likert Resemblance Scale (1-7) During Different Tests	125
Figure 4.15	Mean Rating For Similarity of Basic Skating Skills of the Different Tests as Compared to the Game of Ice-Hockey (n=16)	126
Figure 4.16	Mean Rating of Similarity of Intensity of the Different Tests as Compared to the Game of Ice-Hockey (n=16)	127
Figure 4.17	Mean Rating of Suitability of the Different Tests to Evaluate Aerobic Fitness of Hockey Players (n=16)	128
Figure 4.18	Mean Ratings With Regard to Suitability of Each Test to Evaluate Overall Fitness (Including Muscular & Cardiovascular Fitness) of Hockey Players (n=16)	129

Figure 4.19	Mean Rating of Suitability of Tests to Evaluate Overall Fitness in Ice-Hockey Players (n=16)	130
Figure 4.20	Progression of Speed in the Three ice-Skating Protocols	133

## LIST OF ABBREVIATIONS

%	percentage (one part in every hundred)
°/s	degrees per second (measurement of angular velocity)
°C	degree Celsius (measurement of temperature)
<b>20 MST</b>	20 Metre Multistage Shuttle Run Test (field test that predicts maximal oxygen consumption)
<b>MS20MST</b>	Modified (Skating) 20 Metre Shuttle Test
<b>ft</b>	foot (linear measurement of distance)
<b>FAST</b>	Faught Aerobic Skating Test
<b>g</b>	gram (unit of mass)
<b>HR</b>	heart rate (measured in beats per minute)
<b>HR max</b>	maximal heart rate (measured in beats per minute)
<b>kg</b>	kilograms (unit of mass)
<b>km h<sup>-1</sup></b>	kilometres per hour (unit of speed or velocity)
<b>cm</b>	centimetre (linear measurement of distance)
<b>m</b>	metre (linear measurement of distance)
<b>min</b>	minutes (unit of time)
<b>m min<sup>-1</sup></b>	metres per minute (unit of speed or velocity)
<b>m s<sup>-1</sup></b>	metres per second (unit of speed or velocity)
<b>m min<sup>-1</sup></b>	metres per minute (unit of speed or velocity)
<b>MET</b>	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)

<b>ml</b>	millilitre (unit of volume or capacity)
<b>ml kg<sup>-1</sup> min<sup>-1</sup></b>	millilitre per kilogram of body mass per minute (unit of oxygen consumption)
<b>mmHg</b>	millimetres mercury (unit of measure of barometric pressure)
<b>mmol L<sup>-1</sup></b>	millimole per litre (unit of molecular weight of a substance; unit of measurement of blood lactic acid)
<b>m h<sup>-1</sup></b>	miles per hour (unit of speed or velocity)
<b>n</b>	number of participants in a group
<b>NHL</b>	National Hockey League
<b>O<sub>2</sub></b>	oxygen
<b>pH</b>	negative decimal logarithm of hydrogen-ion concentration in moles per litre, giving measures of acidity or alkalinity of a solution
<b>r</b>	correlation
<b>r<sup>2</sup></b>	coefficient of determination
<b>RSS</b>	Reed Repeat Sprint Skate Test (requires players to skate 55 m six times every 30 seconds)
<b>s</b>	seconds (unit of time)
<b>SAS<sub>40</sub></b>	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)
<b>SD</b>	standard deviation (the number by which scores deviate from the mean)
<b>SEE</b>	standard error of the estimate (also called standard error of prediction), the amount of error expected in a prediction
<b>SMAT</b>	Skating Multistage Aerobic Test
<b>STPD</b>	the volume of gas expired under standard conditions of temperature (0 °C), pressure (760 mmHg), and dry (no water vapour)



<b>USA</b>	United States of America
<b>VE</b>	minute ventilation (the amount of air expired in one minute)
$\dot{V}O_2$	oxygen consumption (expressed in text as $\dot{V}O_2$ )
$\dot{V}O_2 \text{ max}$	maximal oxygen consumption (measured in litres per minute or as millilitres per kilogram per minute); expressed in text as $\dot{V}O_2 \text{ max}$
<b>W kg<sup>-1</sup></b>	watt per kilogram (unit of power)
<b>yr</b>	year (unit of time)