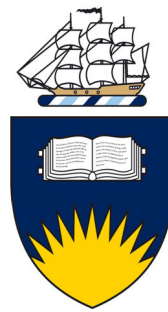


FIELD BASED TESTING PROTOCOLS TO MONITOR TRAINING ADAPTATIONS AND PERFORMANCE IN ELITE ROWERS

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THESIS CONTENTS

CHAPTER 1 - INTRODUCTION, BACKGROUND AND STATEMENT OF PROBLEM

1.1 INTRODUCTION	1
1.2 BACKGROUND	3
1.2.1 Competitive rowing	3
1.2.2 Descriptive characteristics of elite rowers.....	3
1.2.3 Physiological demands of competitive rowing	5
1.2.4 Physiological testing of elite rowers	7
1.3 STATEMENT OF PROBLEM	9
1.3.1 Aims	9
1.3.2 Limitations.....	11
1.3.3 Delimitations	12
1.4 DATA ANALYSIS CONSIDERATIONS.....	14

CHAPTER 2 - LITERATURE REVIEW: ROWING TESTING – LABORATORY AND FIELD PROTOCOLS

2.1 INTRODUCTION	16
2.2 ROWING ERGOMETRY	16
2.2.1 Metabolic cost of rowing.....	17
2.2.2 Aerobic and anaerobic energy contribution	19
2.2.3 Performance determinants and modelling	21
2.2.4 Fitness monitoring.....	23
2.3 LABORATORY BASED ROWING TESTING.....	24
2.3.1 Evaluation of training adaptations.....	24
2.3.2 Definition of lactate thresholds	26
2.3.3 Prescription of rowing training intensities	29
2.4 VALIDITY OF ERGOMETER ROWING	32
2.4.1 Movement patterns	32
2.4.2 Biomechanics	34
2.4.3 Rowing performance	36
2.4.4 Physiological responses.....	36
2.5 ON-WATER INCREMENTAL ROWING PROTOCOLS	38
2.5.1 Methodological limitations.....	39

2.5.2 Measurement of on-water rowing power output	40
2.5.3 Measurement of metabolic load during on-water rowing	41
2.5.4 Reliability	43
2.6 CONCLUSIONS	44

CHAPTER 3 - VALIDATION OF THE CONCEPT2 MODEL D ROWING ERGOMETER

3.1 INTRODUCTION	45
3.2 METHODS	48
3.2.1 Subjects	48
3.2.2 Experimental protocol	48
Incremental rowing protocol	48
3.2.3 Statistical analyses	50
3.3 RESULTS	51
3.3.1 Subjects	51
3.3.2 Comparison between ergometer models (C2C vs. C2D)	51
Submaximal performance	51
Maximal performance	51
Blood lactate thresholds	51
3.3.3 Reliability of test results using the C2D ergometer	53
Submaximal performance	53
Maximal performance	53
Blood lactate thresholds	53
3.4 DISCUSSION	60
3.4.1 Comparison between ergometer models (C2C vs. C2D)	60
3.4.2 Reliability of test results using the C2D ergometer	61
3.4.3 Practical applications	61
3.5 CONCLUSION	65

CHAPTER 4 - VALIDITY OF THE METAMAX3B PORTABLE METABOLIC SYSTEM

4.1 INTRODUCTION	66
4.2 METHODS	69
4.2.1 Subjects	69
4.2.2 Indirect calorimetry equipment	69
Portable metabolic system	69
Laboratory metabolic system	69
Calibration of the metabolic systems	72
Metabolic simulation system	74
4.2.3 Experimental protocol	74
Incremental rowing protocol	76
4.2.4 Statistical analyses	77
Reliability	77

Accuracy	78
4.3 RESULTS	79
4.3.1 Simulated metabolic outputs	79
4.3.2 Power output during biological trials	79
4.3.3 Biological trials	81
4.4 DISCUSSION.....	88
4.4.1 Reliability of repeated MM3B measurements.....	88
4.4.2 Accuracy of the MM3B compared with an automated Douglas bag system (MOUSE).....	89
4.5 CONCLUSIONS	93

CHAPTER 5 - COMPARISON OF ERGOMETER AND ON-WATER INCREMENTAL ROWING TESTS

5.1 INTRODUCTION	94
5.2 METHODS	98
5.2.1 Subjects	98
5.2.2 Experimental protocol	98
Laboratory test protocol.....	101
On-water test protocol.....	101
Blood lactate thresholds	102
5.2.3 Data treatment	103
5.2.4 Statistical analyses.....	107
5.3 RESULTS	109
5.3.1 Comparison between test modalities (laboratory vs. on water)	109
Power output measurements	109
Submaximal performance	109
Maximal performance	109
Blood lactate thresholds	112
5.3.2 Reliability of measures on water	112
Submaximal performance	112
Maximal performance	112
Typical error results	112
5.4 DISCUSSION.....	116
5.4.1 Comparison between test modalities (laboratory vs. on water)	117
5.4.2 Reliability of measures on water	121
5.5 CONCLUSION	125

CHAPTER 6 - MONITORING FITNESS AND PERFORMANCE WITH ERGOMETER AND ON-WATER INCREMENTAL ROWING TESTS

6.1 INTRODUCTION	126
6.2 METHODS	129
6.2.1 Subjects	129
6.2.2 Experimental protocol	129

2000-m ergometer time-trial	131
Laboratory test	131
On-water incremental test	132
Blood lactate thresholds	133
6.2.3 Data treatment	133
6.2.4 Statistical analyses.....	134
Classification of magnitude-based differences	134
Practically substantial differences based on the smallest worthwhile change	135
Prediction of rowing time-trial performance	135
6.3 RESULTS	138
6.3.1 Training logs.....	138
6.3.2 2000-m ergometer time-trial.....	138
6.3.3 Ergometer and on-water incremental rowing tests.....	138
Magnitude-based differences between baseline and post- training results.....	138
Practical interpretation of the baseline to post-training changes.....	139
Comparison of physiological responses to ergometer and on- water rowing	139
6.3.4 Relationship between incremental rowing test results and performance.....	145
6.4 DISCUSSION.....	147
6.4.1 Magnitude-based differences between baseline and post-training results	147
Practical interpretation of the baseline to post-training changes.....	149
6.4.2 Comparison of ergometer and on-water physiological responses.....	149
6.4.3 Relationship between incremental rowing test results and performance.....	150
6.5 CONCLUSIONS	152
 CHAPTER 7 - SUMMARY, CONCLUSIONS AND RECOMMENDATIONS	
7.1 SUMMARY.....	153
7.2 PRACTICAL APPLICATIONS.....	158
7.3 FUTURE DIRECTIONS	159
 REFERENCES	 161
 APPENDIX - PUBLICATIONS.....	 175

FIGURES

- Figure 2-1:** LT_1 (aerobic threshold) and LT_2 (AT) blood lactate thresholds determined by ADAPT software (AIS, Canberra, Australia) from the blood lactate-power output curve established during a 6-stage incremental rowing test.28
- Figure 2-2:** Kinetic energy of the rower's body during a single rowing stroke performed on a stationary ergometer (ergo) and on-water (boat) and the kinetic energy of the boat (shell).33
- Figure 3-1:** (A) Blood lactate concentration and (B) heart rate during the incremental rowing protocol performed on Concept2 Model C and Model D ergometers.55
- Figure 3-2:** Oxygen economy during the incremental rowing protocol performed on Concept2 Model C and Model D ergometers.57
- Figure 3-3:** (A) Blood lactate concentration, (B) heart rate and (C) oxygen consumption during both incremental rowing protocols performed on the Concept2 Model D ergometer.58
- Figure 4-1:** Oxygen consumption ($\dot{V}O_2$), carbon dioxide production ($\dot{V}CO_2$), respiratory exchange ratio (RER) and ventilation ($\dot{V}E$) as measured by the criterion MOUSE system during the incremental rowing test, and by the MM3B during Trial 1 and Trial 2 of duplicate rowing tests.83
- Figure 4-2:** Bland-Altman plots of individual errors from duplicate MM3B trials (Trial 2 - Trial 1) during each workload of the incremental rowing test for oxygen consumption ($\dot{V}O_2$), carbon dioxide production ($\dot{V}CO_2$), respiratory exchange ratio (RER) and ventilation ($\dot{V}E$).85
- Figure 4-3:** Bland-Altman plots of individual errors (MM3B - MOUSE) from each of the workloads during the incremental rowing test for oxygen consumption ($\dot{V}O_2$), carbon dioxide production ($\dot{V}CO_2$), respiratory exchange ratio (RER) and ventilation ($\dot{V}E$).87
- Figure 5-1:** Mean power output during submaximal and maximal workloads for the ergometer (ERG) and on-water (OW) incremental tests.104
- Figure 5-2:** Mean results for A) blood lactate (BLa), B) heart rate (HR) and C) oxygen consumption ($\dot{V}O_2$) using untreated data that does not account for the differences in submaximal workloads between ergometer (ERG) and on-water (OW) incremental rowing tests.105
- Figure 5-3:** Mean submaximal results for A) heart rate (HR), B) blood lactate (BLa), C) oxygen consumption ($\dot{V}O_2$) and D) distance completed during ergometer (ERG) and on-water (OW) tests based on power normalised data using the standard power outputs.110
- Figure 5-4:** Trial 1 (x axis) vs. Trial 2 (y axis) scatter plots and linear regression trendlines for A) heart rate (HR), B) blood lactate concentration (BLa), C) oxygen consumption ($\dot{V}O_2$) and D) distance completed during repeated on-water (OW) incremental rowing tests.114

Figure 6-1: Mean results for heart rate (HR) using untreated data that does not account for the differences in submaximal workloads between A) the ergometer (ERG) and on-water (OW) incremental rowing tests, and B) the baseline and post-training tests using the OW protocol.	136
Figure 6-2: Average change in power output for individual athletes during the baseline and post-training 2000-m ergometer time-trials (TT).	142
Figure 6-3: Mean results using normalised submaximal data based on the standard power outputs for A) blood lactate (BLa), B) heart rate (HR) and C) oxygen consumption ($\dot{V}O_2$) during the baseline and post-training ergometer (ERG; left) and on-water (OW; right) incremental rowing tests.	143

TABLES

Table 1-1:	2000-m race times for finalists in World Cup, World Championship and Olympic regattas 2000-2004.	4
Table 1-2:	Summary of published literature relating to the physiological demands of competitive rowing for national level rowers.	6
Table 2-1:	Summary of literature on performance modelling of competitive rowing. Displayed values are correlation coefficients (R) between selected physiological and anthropometric variables and rowing time-trial performance.	22
Table 2-2:	Contemporary training intensity zones and traditional rowing classifications based on LT ₁ and LT ₂ blood lactate thresholds, and approximate heart rate and blood lactate concentration equivalents for a male heavyweight rower.	31
Table 3-1:	Subject description and performance characteristics during 4 min maximal ergometer rowing for males (<i>n</i> =6) and females (<i>n</i> =2).....	52
Table 3-2:	Power output, stroke rate and selected physiological variables during incremental rowing performed on Concept2 Model C and Model D ergometers.	56
Table 3-3:	LT ₁ and LT ₂ thresholds calculated from blood lactate-power output relationships during incremental rowing performed on Concept2 Model C and Model D ergometers.....	57
Table 3-4:	Reliability (% TE) of repeated measurements during the submaximal and maximal portions of the incremental rowing tests performed on the Concept2 Model D rowing ergometer.....	59
Table 4-1:	Physical characteristics of the subjects.	70
Table 4-2:	Simulated metabolic outputs for five different settings using the metabolic calibrator (<i>italicised</i>) and the corresponding mean results from either one trial (MM3B) or duplicate trials (MM3B2) with the MM3B portable metabolic system.	80
Table 4-3:	Differences between MM3B results during each stage of the duplicate incremental rowing tests (trial 2 - trial 1).....	84
Table 4-4:	Differences between metabolic measurements from the criterion MOUSE system and mean results from the two MM3B trials during each stage of the incremental rowing tests (MM3B - MOUSE).....	86
Table 5-1:	Physical characteristics of the subjects.	99
Table 5-2:	Regression analyses between measured variables and power output during ergometer (ERG) and on-water (OW) incremental rowing tests using pooled results from all subjects.	106
Table 5-3:	Mean (SD) performance characteristics during the maximal stage of the ergometer (ERG) and on-water (OW) tests.....	111
Table 5-4:	LT ₁ (aerobic) and LT ₂ (anaerobic) thresholds calculated from blood lactate-power output relationships using untreated data from the ergometer (ERG) and on-water (OW) tests.....	111

Table 5-5:	Reliability of repeated measurements during submaximal and maximal performance of on-water (OW) and ergometer (ERG) incremental rowing tests as indicated by relative typical error (%TE) and 90% confidence limits (90% CL).	115
Table 5-6:	Heart rate based training zones for two athletes displaying divergence between LT ₁ and LT ₂ heart rate results from the ergometer and on-water rowing tests.....	122
Table 6-1:	Physical characteristics of the 7 subjects.	130
Table 6-2:	Regression analyses between measured variables and power output during ergometer (ERG) and on-water (OW) incremental rowing tests using pooled results from all subjects.	137
Table 6-3:	Summary of the training completed during the 6-wk training period based on self-reported training logs.	141
Table 6-4:	Mean (SD) performance characteristics during the 2000-m ergometer time-trial (TT).....	142
Table 6-5:	Lactate threshold results and performance characteristics from the maximal stages of the ergometer (ERG) and on-water (OW) incremental rowing tests during baseline and post-training testing... ..	144
Table 6-6:	Linear regression analyses between selected results from the ergometer (ERG) and on-water (OW) incremental rowing tests and rowing performance (2000-m ergometer time-trial time and maximal power output from the on-water test) during the baseline and post-training test blocks.....	146

PLATES

- Plate 3-1:** The Concept2 Model C ergometer (C2C), including: A) PM2 work monitor unit; B) flywheel enclosure, and C) straight-design handle.47
- Plate 3-2:** The Concept2 Model D ergometer (C2D), including: A) PM3 work monitor unit; B) updated flywheel enclosure, and C) new 10° bent-handle.47
- Plate 4-1:** The MetaMax3B portable indirect calorimetry system, including: A) gas analysis-data telemetry module; B) telemetry receiver unit, and C) volume turbine assembly.71
- Plate 4-2:** The laboratory-based Maximum Oxygen Uptake System electronic (MOUSE) indirect calorimetry system, including: A) volume piston; B) AEI Technologies CD-3A CO₂ gas analyser; C) AEI Technologies S-3AI O₂ analyser; D) computer interface, and E) Mylar Douglas bags.73
- Plate 4-3:** The metabolic simulation system, including: A) computer interface; B) respiratory port, and C) internal mechanics.75
- Plate 5-1:** The WEBA Sport biomechanics system.97
- Plate 5-2:** A rower undertaking an on-water test on the Lake Burley Griffin rowing course.100

ABSTRACT

Laboratory-based rowing tests are the established standard for assessing fitness traits among elite rowers, and for prescribing individualised exercise intensities for training. But because tests occur on a rowing ergometer, the specificity of laboratory testing has been questioned compared with the criterion of on-water rowing. This project validated equipment required to replicate a laboratory-based rowing test in the field and evaluated the feasibility of on-water tests. Ergometer and on-water test results were compared to assess the validity of ergometer-derived training prescriptions and to establish the effectiveness of on-water tests for monitoring longitudinal fitness changes and for predicting rowing performance.

Concept2 rowing ergometers (Morrisville, USA) have frequently been used for rowing tests. Although subtle design variations exist between the different models of Concept2 ergometer, there were no substantial differences between the results from incremental rowing tests using Model C and Model D ergometers. The Concept2 Model D was therefore accepted as the standard ergometer for subsequent laboratory tests. Typical error (TE) results from duplicate Concept2 Model D tests conducted 2-4 d apart showed that laboratory tests were highly reliable (TE: maximal power = 2.8%, peak oxygen consumption = 2.5%).

As oxygen consumption ($\dot{V}O_2$) is measured routinely during laboratory rowing tests, it is necessary to obtain similar measurements during any on-water protocol. The MetaMax 3B portable indirect calorimetry system (Cortex, Leipzig, Germany) was therefore validated against a first-principles, laboratory-based indirect calorimetry system (MOUSE, Australian Institute of Sport, Canberra, Australia). $\dot{V}O_2$ from the MetaMax was significantly higher during submaximal exercise ($p=0.03$), although results were within $0.16 \text{ L}\cdot\text{min}^{-1}$ (4.1%) across all exercise intensities. There was good agreement between duplicate MetaMax trials separated by ~ 2 d; mean $\dot{V}O_2$ was within $0.11 \text{ L}\cdot\text{min}^{-1}$ (2.5%) and TE was $\leq 2.3\%$.

The specificity of rowing testing was improved using an On-water incremental test that replicated a laboratory-based Ergometer protocol. However, the individual variation in physiological responses between-tests meant that training intensity recommendations from the Ergometer test were not always applicable to on-water

training. Furthermore, measurements from the On-water protocol displayed similar or lesser reliability (TE=1.9-19.2%) compared with the Ergometer test (TE=0.1-11.0%).

As an effective fitness test must also be sensitive to longitudinal changes, the responses to 6 wks training were compared between the Ergometer and On-water methods. The magnitude of On-water training effects were usually greater (small Cohen's effect size) compared with the Ergometer test (trivial effect), although On-water and Ergometer tests both indicated that training responses were negligible because virtually all changes were less than one of their respective TEs. Correlations between test results and rowing performance were largest when rowing mode was matched between conditions, but Ergometer results provided the highest correlations (Ergometer vs. 2000-m ergometer time-trial: $R = -0.92$ to -0.97 compared with On-water vs. On-water maximal power output: $R = 0.52$ to 0.92).

Although On-water tests improved the specificity of on-water training prescriptions, these tests provided no obvious benefits for monitoring longitudinal fitness changes or performance compared with Ergometer tests. Given that On-water tests are also more time consuming and logistically challenging, their practical application is limited.

DECLARATION

I certify that this thesis does not incorporate without acknowledgement any material previously submitted for a degree or diploma in any university; and that to the best of my knowledge and belief it does not contain any material previously published or written by another person except where due reference is made in the text.



Andrew J. Vogler

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