Determinates of 5-Kilometer Ergometer Rowing Performance in Division 1 Female Collegiate Rowers

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ABSTRACT

This study looked at determinates of 5-kilometer rowing performance in division 1 female collegiate rowers. 18 female collegiate rowers were tested for lactate threshold, isometric strength, lean body mass, and V02 max. Analysis of the data revealed that wattage at 4mmol and lean body mass provide the most explanation of 5-kilometer rowing performance. This provides coaches with information to program proper training for athletes to find the most success in the sport.

INTRODUCTION

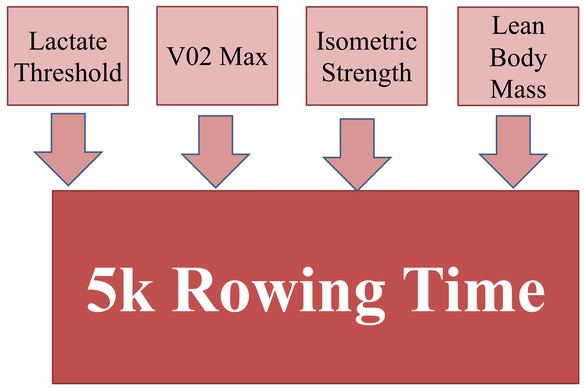
Rowing is an endurance-based sport, contested on water, where rowers must complete a specified distance as quickly as possible. Aerobic factors are the main determinants of performance, but individuals must also possess strength, muscular power, technique, and racing tactics. [1] With 156 collegiate varsity rowing programs in the United States [2] and 89 Division 1 programs, each of these programs averaging 47 athletes; approximately 8000 athletes compete in rowing every year. The collegiate fall season covers 5-kilometers while the spring season covers 2-kilometers. Typically, a 5-kilometer race can take up to 24 minutes while a 2-kilometer race can be completed in under 8 minutes. Rowing performance is dependent on many factors including the physiology and overall mechanics of the rower, the type of boat, climate conditions [3] and the environment.[4,5]

PURPOSE

To determine which performance indicators reflect 5km ergometer rowing performance in division-1 collegiate women's rowing.

METHODS

- 18 female collegiate rowers (18 ± 4 years, 79.1 ± 45.7kg, 172 ± 20cm) underwent 3 testing sessions over the span of 3 months.
- Lactate threshold (LT) was measured in the first session using a Concept2 ergometer with 4 stages.
- VO2 max was measured in the second session using a Concept2 ergometer with 7 stages.
- Isometric strength testing was conducted in the third session for upper musculature using an isometric row (IR) and lower body musculature using an isometric squat (IS).
- Lean body mass (LBM) was obtained using Bod Pod; 5km rowing performance data was collected on a Concpet2.
- Data was analyzed with a backwards stepwise regression



RESULTS

All data was found to be normally distributed. Statistically significant values were obtained from all analysed models. Values for models 1-4 can be found in Table 1, with an outcome of F (2,16) = 18.676, $p < .001$).

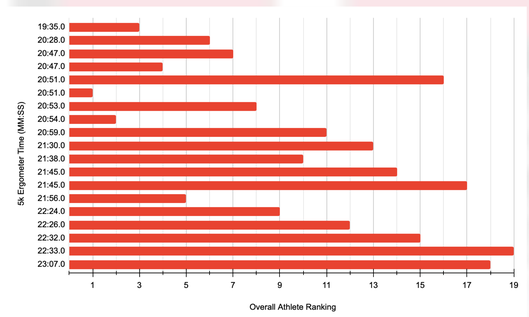
Table 1: Backwards Stepwise Regression Outcomes

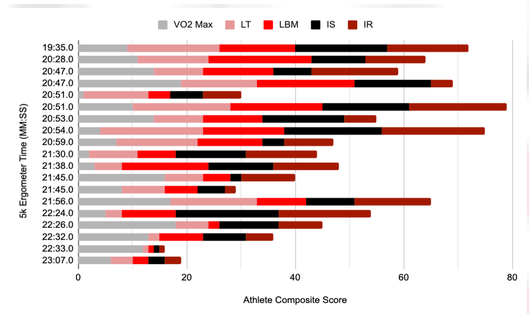
Variable	*p*	1	2	3	4
IS (N)		0.873			
VO_2 Max (ml·kg·min)	< .001	0.590	0.575		
IR (N)	< .001	0.481	0.298	0.341	
LBM (kg)	< .001	0.063	0.045*	0.046*	0.068
LT (w)	< .001	0.009*	0.007*	0.005*	0.007*

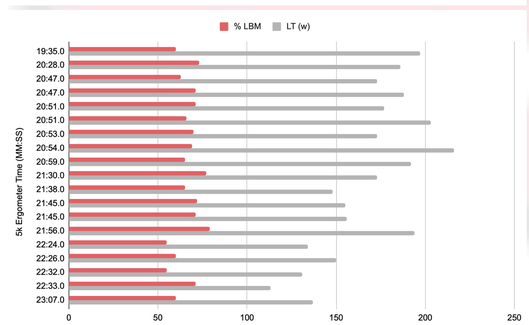
*Note: IS=isometric squat; IR =isometric row; LBM=lean body mass; LT=wattage at 4 mmol; *= p< 0.05*

DISCUSSION

- The study aimed to identify performance indicators for 5k ergometer rowing performance in division 1 female collegiate rowing.
- Wattage at 4mmol and LBM accounted for 70% of the variance in 5k ergometer rowing performance.
- Power at a blood lactate concentration of 4mmol was found to be a physiological characteristic of high performance rowers .
- Top performers in the study had a higher wattage output at the same lactate levels therefore having a higher work rate compared to less trained athletes; aligning with previous research.
- Lean body mass strongly correlated with overall performance, with better rowers having a higher percent LBM compared to lower performers.







CONCLUSION

The composite score of all the tests may be significant of performance in this population however, wattage at 4mmol and lean body mass provide the most explanation of 5-kilometer ergometer rowing performance.

PRACTICAL APPLICATIONS

Wattage at 4mmol and LBM provided the most explanation for 5-kilometer ergometer rowing performance. It is suggested that coaches focus on training protocols focusing on athlete's lactate threshold values, while also utilizing exercise programs targeting an increase in overall LBM. Programs should focus on leg strength as well as the posterior muscles as these groups are used while rowing on the ergometer as well as in the boat during on-water training. This data suggests coaches should focus training on developing the lactate threshold to improve wattage output during rowing and focus resistance training methods on developing lean body mass of key muscles associated with rowing performance. Training protocols focusing on leg strength as well as targeting the upper body posterior muscles would be useful as the athletes use both these muscle groups when performing rowing actions on the ergometer as well as in the boat during on-water training.

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