EJSS - Journal
Sport & Exercise Sciences

Section B

doi: 10.12863/ejssax1x1-2013x1

# ANALYSIS OF ANAEROBIC POWER IN CLUB LEVEL YOUNG ROWERS

Angelo Cataldo[1], Dario Cerasola[1,2], Giuseppe Russo[1], Daniele Zangla[1,2], Marcello Traina[1]

[1]*Sport and Exercise Sciences "DISMOT" Research Unit, University of Palermo, Italy*
[2]*Italian Rowing Federation*

## Abstract

**Aim:** To date, assessment of the anaerobic components to determine performance in rowers is not part of standard evaluation or monitoring set for training. The aim of this study was to evaluate the relation between anaerobic power output and ergometer rowing performance over 2000 meters, in a group of 14 - 17 years old rowers (n = 11).
**Methods:** Each subject performed, in three separate days, two "all-out" tests, over 20 and 60 seconds, and a 2000 meters trial, using a Concept II rowing ergometer. Mean power values over 20 sec (W20) and 60 sec (W60) were measured and compared with the time to perform the 2000 m trial (t2000).
**Results:** Statistical analysis showed high and significant correlation between 2000 meters performance (6.90 ± 0.1 min) and anaerobic power over 20 sec (479.5 ± 93.90 watts; r = 0.941, P = 0.00002) and 60 sec (435.5 ± 64.60 watts; r = 0.964, P = 0.000002).
**Conclusions:** The data of our study confirm that parameters of anaerobic power strongly affect the performance and that the determination of these variables by testing on rowing ergometer can be an useful tool for planning and monitoring of training in young rowers.

**Keywords:** Rowing, Anaerobic power, Ergometer test, Performance.

## Introduction

Rowing is a discipline dependent upon the functional capacities of both aerobic and anaerobic energy systems (Secher 1973; Steinacker 1993). Racing will take place over distance of 2000 meters and lasts 5-8 minutes, depending on the different types of boat and categories and weather conditions, with a relative amount of energy estimated to be 25-35% from anaerobic and 65-75% from aerobic metabolism (Droghetti et al. 1991; Ingham et al. 2002; Steinacker 1993). Several studies have shown that some anthropometric parameters, including body weight and height (Secher 1973), appear to greatly affect the performance, and the maximum oxygen uptake, index of aerobic power, is the best predictor of performance in elite rowers (Cosgrove et al. 1999; Ingham et al. 2002; Secher 1993). In addiction, some evidence is that muscle power output, indicator of anaerobic power, could be an important

Corresponding Author: Angelo Cataldo, M.Sc., Ph.D. Student
University of Palermo
Via E. Duse, 2 – 90146 Palermo
angelo.cataldo@unipa.it
Received: January 2013 – Accepted: June 2013

predictor of performance (Izquierdo-Gabarren et al. 2010; Lawton et al. 2011; Mikulic et al. 2009; Riechman et al. 2002).

Despite the race performance also depends on external factors such as environmental conditions, the use of specific ergometers allows faithful reproduction of the technical gesture and is useful both for indoor training, and for the evaluation of the performance on distance race (Schabort et al. 1999).

In a previous study, performed in a limited number of subjects, we have shown the existence of a close relationship between parameters of anaerobic power and performance on rowing ergometer in young rowers (Cataldo et al. 2012).

The aim of this study was to evaluate specific anaerobic power in a larger sample of subjects using rowing ergometer tests and to confirm the relation between anaerobic power outputs and 2000 meter rowing ergometer performance.

## Methods

The study involved 11 young male rowers, age 14-17, affiliated with a rowing club member of the Italian Rowing Federation. All of them practiced rowing at least two years. All experimental procedures were conducted in exercise laboratory of Sport and Exercise Sciences “DISMOT” Research Unit of University of Palermo. Each subject’s parents gave written informed consent and the study was approved by the IRB Committee at our institution.

Anthropometric parameters were measured before starting the tests, and stature, body mass, and percentage of body fat mass were collected.

All evaluations were performed on a Concept II model D air braked rowing ergometer (Concept2, Nottingham UK) on three separate days of the same week, during the pre-competitive period.

Every subject, before each test, warmed up for 15-20 minutes on the rowing ergometer, according to his usual habits, and then performed a maximal effort test over 20 seconds (the first day) and over 60 seconds (the second day). Power output values in watts (W) were measured for each stroke and displayed by the Concept II PM3 computer, and the average power for each test (W20 and W60) was calculated.

On the third day, each participant performed a trial over 2000 meter and the time of trial (t2000) was chosen as the index of performance.

The results were expressed as mean ± standard deviation (SD). For the statistical analysis of the data, the time to perform 2000 meters was used as the dependent variable (y), while the power output and the anthropometric parameters as independent variables (x). To determine the correlations between the variables we used the Pearson correlation coefficient (r) and the linear regression analysis was calculated to identify the best predictor of performance. Statistical significance was accepted for levels of $P < 0.05$.

## Results

Anthropometric characteristics and power output values of subjects, with the correlations between measured variables and performance, are shown in Table 1. The average of time to perform 2000 meters was 6.90 ± 0.1 min. Among the anthropometric parameters, statistically significant correlation was found for stature (172.9 ± 4.0 cm; r = 0.949, P = 0.00001) and body mass (67.3 ± 8.2 Kg; r = 0.695, P = 0.02).

Both indicators of anaerobic power, W20 (479.5 ± 93.90 watts) and W60 (435.5 ± 64.60 watts), showed highly significant correlation with the performance (r = 0.941, P = 0.00002; r = 0.964, P = 0.000002 respectively) (Figure 1; Figure 2).

Table 1. Characteristics of the partecipants (n = 11 ; mean ± SD), mean power during 20 sec (W20) and 60 sec (W60) all-out test and their correlations with performance (t2000).

| | Mean ± SD | r (t2000) | P |
|---|---|---|---|
| Age (years) | 14.8 ± 1.2 | -0.141 | ns |
| Stature (cm) | 172.9 ± 4.0 | -0.949 | 0.00001 |
| Body mass (Kg) | 67.3 ± 8.2 | -0.695 | 0.02 |
| Body fat mass (%) | 12.3 ± 6.6 | -0.147 | ns |
| W20 (Watt) | 479.5 ± 93.9 | -0.941 | 0.00002 |
| W60 (Watt) | 435.5 ± 64.6 | -0.964 | 0.000002 |
| t2000 (min) | 6.90 ± 0.4 | - | - |

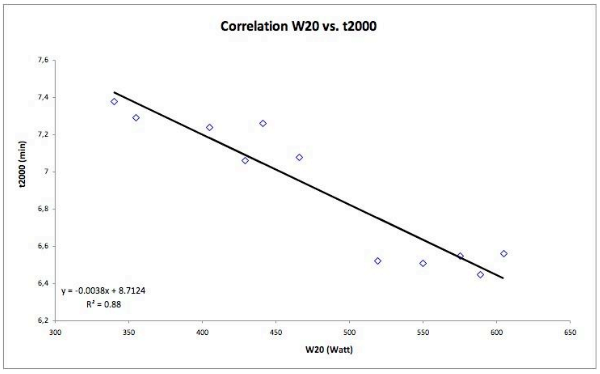


Figure 1. Linear regression between average power over 20 sec and time to perform 2000 metres.

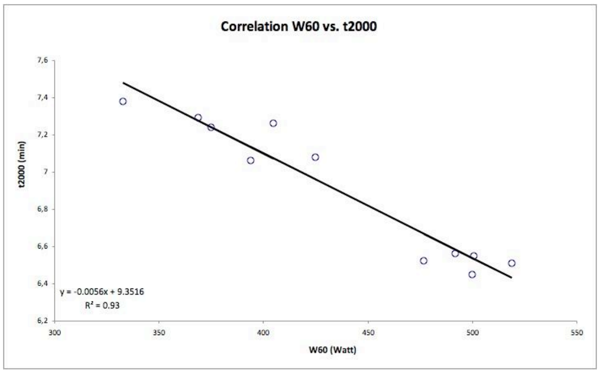


Figure 2. Linear regression between average power over 60 sec and time to perform 2000 metres.

## Conclusions

In rowing, the distance of 2000 meters results in a maximum commitment of both aerobic and anaerobic systems. Moreover, anthropometric parameters are highly correlated with performance.

Maximal oxygen uptake, index of aerobic power, is considered the best predictor of rowing ergometer performance over 2000m but to date, assessment of anaerobic component to determine performance is not part of standard evaluation or monitoring set in rowers.

The data of our study confirm the importance, even in young rowers, of the anthropometric variables such as stature, a not trainable parameter, and body weight. Of particular importance is the finding of a highly significant correlation between the average power outputs over 20 and 60 seconds, and the time to complete the 2000 meters. This correlation confirms that parameters of anaerobic power strongly affect the performance and that the determination of these variables by testing on rowing ergometer can be an useful tool for planning and monitoring of training in young rowers.

## References

1. Secher NH (1973) Development of result in international rowing championship 1893-1971. Med Sci Sports 5: 195-199.
2. Steinacker JM (1993) Physiological aspects of training of rowing. Int. J. Sports Med. 14:S3-S10.
3. Droghetti P, Jensen K and Nilsen TS (1991). The total estimated metabolic cost of rowing. FISA Coach, 2, 1- 4.
4. Ingham SA, Whyte GP, Jones K, Nevill AM (2002) Determinants of 2000m rowing ergometer performance in elite rowers. Eur J Appl Physiol 88(3): 243–246.
5. Cosgrove MJ, Wilson J, Watt D, Grant SF (1999) The relationship between selected physiological variables of rowers and rowing performance as determined by a 2000m ergometer test. J Sports Sci 17(11): 845–852.
6. Secher N (1993) Physiological and biomechanical aspects of rowing. Implications for training. Sports Med 15: 24-4230 .
7. Izquierdo-Gabarren M, Gonzalez de Txabarri Exposito R, Saez Saez de Villareal E, Izquierdo M (2010) Physiological factors to predict on traditional rowing performance. Eur J Appl Physiol 108(1):83-92.
8. Lawton TW, Cronin JB, McGuigan MR (2011) Strenght testing and training of rowers. Sports Med 41(5): 413-432.

9. Mikulic P, Ruzic L, Markovic G (2009) Evaluation of specific anaerobic power in 12–14-year-old male rowers. Journal of Science and Medicine in Sport (12) 662–666.

10. Riechman SE, Zoeller RF, Balasekaran G, Goss FL, Robertson RJ (2002) Prediction of 2000m indoor rowing performance using a 30 s sprint and maximal oxygen uptake. J Sports Sci 20(9): 681–687.

11. Schabort EJ, Hawley JA, Hopkins W, Blum H (1999) High reliability of performance of well-trained rowers on a rowing ergometer. Journal of Sport Sciences 17(8), 627-63253.

12. Cataldo A, Cerasola D, Bellavia D, Russo G, Zangla D, Traina M (2012) Anaerobic test on rowing ergometer in young rowers. Sport Sciences for Health 8(1): 29.

13. Cataldo A, Cerasola D, Zangla D, Traina M (2012) Relazione tra potenza anaerobica e prestazione in giovani canottieri: come programmare e monitorare l'allenamento. Sport&Medicina 6:29-30.