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## COMPARISON OF THE 400 METRE TIMED ENDURANCE SURF PADDLE BETWEEN ELITE COMPETITIVE SURFERS, COMPETITIVE SURFERS AND RECREATIONAL SURFERS

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### INTRODUCTION

Surfing is an intermittent, high performance sport requiring the athlete to perform multiple endurance paddling bouts and explosive paddling bursts to catch the wave (1-3). Due to these demands surfing has been documented as a sport requiring high muscular endurance and power of the upper torso, excellent cardio-respiratory fitness and the ability to rapidly recover (4-6). In addition, surf competitions demand that athletes possess the ability to out paddle the opposition to gain an optimal position for wave take offs, and also need to gain enough momentum to catch waves (1-4). Those who can out paddle a heat opponent, and catch waves at the most critical point when breaking, are likely to maximize their scoring potential.

Given the high metabolic demands of surfing (1-3), literature on surfers' aerobic characteristics is surprisingly limited. Previous studies have utilized laboratory-based ergometers as an alternative to swimming pool-based testing to investigate peak or maximal aerobic capacity ( $VO_{2peak}$  or  $VO_{2max}$ ) (1, 5-8). These studies reported no correlations between a surfer's season rank and  $VO_{2Peak}$  recorded from land based ergometry testing. Furthermore, from the current studies (6, 7), it is still uncertain how the peak power outputs measured on the ergometer correlates with power generated when paddling on-water during surfing. Currently appropriate and valid testing protocols evaluating the physiological fitness of surfing athletes are not well established. Therefore, the purpose of this study was to determine whether the testing procedure of a pool based, 400m endurance time trial (9) is more appropriate given the nature of the sport, and provide a test that is a better discriminator of performance.

### METHODS

#### Experimental Approach

The aim of study was to compare various on-water measurement of aerobic performance between surfers of varying competitive ability (elite, comp, recreational) in order to ascertain if such tests could be used to discriminate differences in paddle and physiological characteristics of surfers. The 400m paddle times and average aerobic speed (400/completion time) of elite adult surfers i) World Championship Tour (WCT), and ii) World Qualifying Series (WQS), elite junior surfers iii) National selection team, competitive surfers iv) competitive club board riders, and v) junior high school competitors, and vi) recreational surfers were compared.

#### Subjects

A total of 59 subjects were analysed for this study. This cohort was made up from; WCT surfers (n=2, 29.3 yrs.  $\pm$  1.34), WQS surfers (n=12, 22.1 yrs.  $\pm$  3.09), national selection team n=10, 16.5 yrs.  $\pm$  1.02), competitive club board riders n=11, 25.6 yrs.  $\pm$  5.84), junior high school competitors (n=7, 16.1 yrs.  $\pm$  1.23), and recreational surfers (n=17, 32.6 yrs.  $\pm$  6.8).

#### Procedures

All endurance paddle trials for this study were performed in the same outdoor 25m swimming pool. The timed 400m endurance paddle test was based over a 20m up and back course, with two buoys placed 2.5m in from each end of the pool to provide the 20m distance. To complete the total of 400m the subjects were required to lie prone on their surfboard and paddle the 10 laps (up and back) as fast as possible. Prior to testing all participants performed as standardised warm-up consisting of a 100m paddle divided into 25m bouts at 50, 60, 70 and 80% of maximal paddling speed. All participants were required give consent for the testing and to be free from illness/injuries, hydrated and follow their normal structured training week, with no different in between weeks or heavy training periods prior to testing. All trials were recorded with a digital stopwatch and were compiled between 12:00 and 16:00 hrs. All data was recorded as total time (seconds) and average aerobic speed was derived by dividing the distance covered by the total time. From two trials, the Intra-class Correlation Coefficient (ICC), Typical Error (TE) and Percentage Co-variance (%CV) were calculated for the 400m to determine the reliability and reproducibility of the testing. The ICC was 0.988, TE between two trials was 2.72, and %CV was 2.01.

#### Statistical Analysis

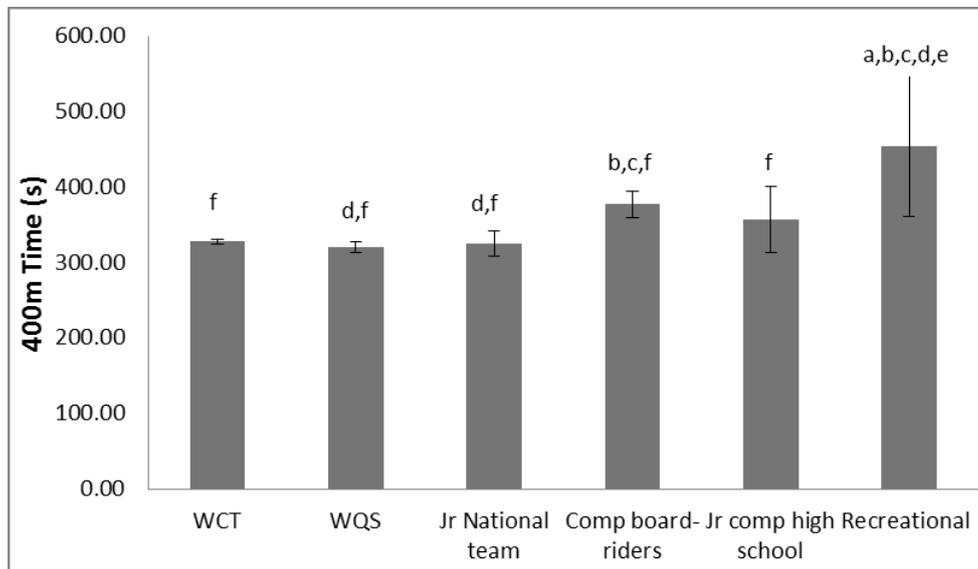
To determine whether any significant differences were present between the groups a one-way analysis of variance was performed. Where a significant main difference was found a LSD post-hoc test was used to identify individual

statistical differences. All statistical analyses were performed using the statistical analysis package SPSS (Version 21.0; Chicago, IL) with statistical significance set at  $p < 0.05$ .

## RESULTS

### 400m endurance paddle

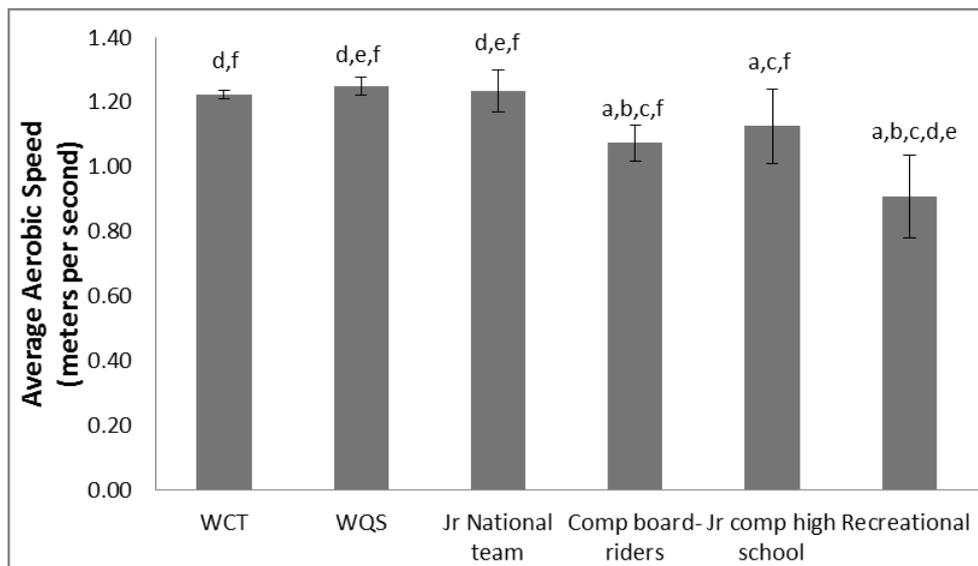
The 400m paddle times of recreational surfers were significantly slower than all other groups ( $WCT$ ;  $p = 0.004$ ,  $WQS$ ;  $p < 0.001$ , *Junior National Selection*;  $p < 0.001$ , *Competitive adult club board-riders*;  $p = 0.001$ , *Junior high school competitors*;  $p = 0.001$ ). Significant differences were also identified between the competitive adult club board-riders and both the  $WQS$  ( $p = 0.019$ ) and *Junior National Selection* surfers ( $p = 0.037$ ). The mean performance times of the groups of athletes are presented in Figure 1.



**Figure 1** - 400m mean paddle times of surfers from varying competitive ability. Significant differences ( $p < 0.05$ ) between groups: <sup>a</sup>= $WCT$ , <sup>b</sup>= $WQS$ , <sup>c</sup>=*Jr Nation team*, <sup>d</sup>=*Comp club board-riders*, <sup>e</sup>=*Jr Comp high school*, <sup>f</sup>=*Recreational*

### Average Aerobic Speed

Significant differences were identified for average aerobic speed between recreational surfers and  $WCT$  ( $p < 0.001$ ),  $WQS$  ( $p < 0.001$ ), *Junior National Selection* ( $p < 0.001$ ), *Competitive adult club board-riders* ( $p < 0.001$ ), and *Junior high school competitors* ( $p < 0.001$ ). Additionally, significant differences were observed between the competitive adult club board-riders and;  $WCT$  ( $p = 0.046$ ),  $WQS$  ( $p < 0.001$ ), *Junior National Selection* ( $p < 0.001$ ). The junior high school competitors also had significantly slower speed compared to same aged junior high school competitors and junior national selection surfers ( $p = 0.029$ ) and  $WQS$  ( $p = 0.012$ ). The mean performance times of the groups of athletes are presented in Figure 2.



**Figure 2** - Mean average aerobic paddle speed of surfers from varying competitive ability. Significant differences ( $p < 0.05$ ) between groups: <sup>a</sup>= $WCT$ , <sup>b</sup>= $WQS$ , <sup>c</sup>=*Jr Nation team*, <sup>d</sup>=*Comp club board-riders*, <sup>e</sup>=*Jr Comp high school*, <sup>f</sup>=*Recreational*

## DISCUSSION

It is believed that a certain level of aerobic capacity is an important requisite for surfing due to the intermittent repeated paddling efforts and is prolonged in nature (1, 3, 10). Yet, a number of previous studies have not observed a significant correlation between peak oxygen uptake and season rank in surfers (1, 5-8), indicating that peak oxygen uptake may not be a defining measure of surfing ability. However, these previous investigations have used primarily stationary paddle ergometers (i.e. open kinetic chain) to examine aerobic capacity, which have produced inconsistent results when discriminating between higher and lower levels of surfers (1, 7-8). In contrast, surfboard paddling is considered a closed kinetic chain activity, (i.e. the surfer 'pulls' their body over the water surface) rather than pulling the water surface toward them and remaining stationary (as with ergometer testing). As such, it is possible that endurance paddling ability is a highly relevant physical quality for surfers (8), but the uses of previous stationary paddle tests are not valid.

Supporting this, the data from the present study indicates that the 400m endurance surf paddle test may be a better discriminator of athletic surfing performance over ergometry testing. Indeed, 400m paddling times and the average aerobic speeds were significantly better in higher level competitive surfers (WCT, WQS and elite junior national team) compared with lower level (Competitive board-riders, high school competitors) and recreational surfers. No difference in 400m paddling times and the average aerobic speeds were observed between higher level competitors.

From the results it can be suggested that younger athletes who reach the sub-elite/elite level of competitive ability are likely to maintain, and potentially increase this level of performance with appropriate training. Training muscular and metabolic systems would put these athletes at an advantage over those who have not yet reached that level of performance, therefore increasing changes of winning and furthering their professional career. In addition, those who are at the elite stage are more likely to out paddle opponents, and catch waves sooner/at the most critical point potentially maximizing scoring chances.

## CONCLUSIONS

According to this study, assessing endurance paddling ability in the water (400m time trial) with surfers will provide greater context validity and along with being more practical, has been shown to effectively discriminate between higher and lower performing surfers. The professional surfing athletes have a greater ability to cover 400m and generate a higher average aerobic speed compared to lower competitive surfers and recreational surfers. The study also suggests that the 400m paddle test is a better discriminator of athletic performance over 'traditional' ergometry testing previously used in studies to date. The significant average aerobic speed differences between higher and lower level competitive surfers appears to highlight the importance of training to improve changes to out paddle opponents and set themselves up to catch waves at the most critical point to maximize point scoring.

## PRACTICAL APPLICATIONS

The 400m endurance surf paddle test is a reliable test, proving discriminatory performance measures that can be easily recorded and replicated in the pool. Given that out paddling your opponent to a wave/gaining priority and withstanding the demands of constant paddling are of utmost importance, training that enhances upper body muscular endurance and power should be implemented in a competitive surfer's training program.

## REFERENCES

1. Meir, R. A., Lowdon, B. J. & Davie, A. J. Heart rates and estimated energy expenditure during recreational surfing. *Australian Journal of Science and Medicine in Sport*. 23:70–74. 1991.
2. Mendez-Villanueva, A., Bishop, D. & Hamer, P. Activity profile of world-class professional surfers during competition: A case study. *Journal of Strength and Conditioning Research*. 20:477–482. 2006.
3. Farley, O., Harris, N. & Kilding, A. Physiological Demands of Competitive Surfing. *Journal of Strength and Conditioning Research*. 26(7):1887–1896. 2012.
4. Lowdon, B. J. Fitness requirements for surfing. *Sports Coach*. 6(4):35-38. 1983.
5. Lowdon, B. J., Bedi, J. F. & Horvath, S. M. Specificity of aerobic fitness testing of surfers. *Australian Journal of Science and Medicine in Sport*. 21:7–10. 1989
6. Farley, O., Harris, N. & Kilding A. Anaerobic and Aerobic Fitness Profiling of Competitive Surfers. *Journal of Strength and Conditioning Research*. 8(26):2243–2248. 2012.
7. Loveless, D. & Minahan, C. Peak aerobic power and paddling efficiency in recreational and competitive junior male surfers'. *European Journal of Sport Science*. 10(6):407-415. 2010.
8. Mendez-Villanueva, A., Perez-Landalunche, J., Bishop, D., Fernandez-Garcia, B., Ortolano, R., Leibar, X. & Terrados, N. Upper body fitness comparisons between two groups of competitive surfboard riders. *Journal of Science and Medicine in Sport*. 8: 43–51. 2005.
9. Sheppard, J. M., McNamara, P., Osborne, M., Andrews, M., Borges, T. O., Walshe, P. & Chapman, D. W. Association between anthropometry and upper-body strength qualities with sprint paddling performance in competitive wave surfers. *Journal of Strength and Conditioning Research*. 26(12):3345-3348. 2012.
10. Mendez-Villanueva, A. & Bishop, D. Physiological aspects of surfboard riding performance. *Sports Medicine* 35:55–70. 2005.