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Podium 3

**A BRIEF EXAMINATION OF STRENGTH AND PADDLE-CONDITIONING CONSIDERATIONS FOR COMPETITIVE SURFERS**

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**COMPETITIVE SURFING DEMANDS**

Competitive surfing involves grouping 2-4 surfers in each competitive heat, which generally lasts 20-30 minutes, dependent on the format of the competition, and the surf conditions. Competitive success is determined by a judging criterion that evaluates the athlete's ability to ride the best waves, performing radical manoeuvres under control. In other words, surfers' success is judged by their ability to obtain and ride the waves with the best scoring potential, and ride them better than their opposition. Like any tournament style competition, the successful surfers from each round of competitive heats progress through the competition until quarter, semi, and final rounds are completed, and placing is determined.

Surfing (wave-riding) competition takes place in a variety of conditions that have a large effect on activity patterns such as duration of wave-riding and time spent paddling (5, 7, 8). The type of wave-break, and changing conditions such as wind, swell, and tide conditions greatly influence the nature of the surfing activity. However, both competitive and recreational surfing suggest that surfing can be characterized as a sport requiring multiple short duration intermittent paddle efforts (5, 7). In a competition, wave riding duration was found to be only 3.8% of total time, with paddling accounting for 51.4% of time, and no activity (i.e. stationary sitting on board) representing 42.5% of total time (miscellaneous activities 2.2%)(7).

**CONDITIONING AND ENDURANCE FACTORS**

Although the mean paddling bout in a surfing competition was found to be ~30 seconds, the majority (~60%) of these paddling bouts were only 1-20 seconds (~25% <10 seconds, ~35% 10-20 seconds), highlighting the importance of shorter bouts of intense paddling (6, 7). Some previous examinations have determined that neither oxygen uptake nor endurance paddling measures are valid in discriminating between competitive and recreational surfers, but that short-duration paddling power may be a valid discriminator (3). Sprint paddling (in order to catch waves and to gain a position advantage over their competitors during a heat) appears to be a key feature of competition in order to gain a position advantage for wave selection, but also to ensure fast entry speed into waves to optimize position on the wave face for the execution of manoeuvres that will maximize the judges' score (3, 6, 9). As such, sprint paddling ability is considered to be a significant factor in determining the competitive outcome.

Clearly, competition and training involves many repeated bouts of sprint and sub-maximal paddling. Therefore, training not only sprint paddling, but also conditioning for these repeated efforts is an important and relevant consideration for the strength and conditioning coach. However, considering that many competitive surfers typically undertake 15-20 hours of surfing (and paddling) in a typical week, the authors believe that additional paddling of a general nature is unlikely to elicit improvements in paddling performance, and may in fact increase the paddling load to an extent that promotes overuse injury.

It is recommended that the coach determine whether weaknesses in paddling performance do exist within an individual surfer, and then evaluate where these weaknesses may stem from (e.g. strength, technique, conditioning?). If the surfer is found to be poor in their sprint paddle, yet is relatively strong and appears to have good technique, then sprint paddle training is likely an appropriate intervention. If the ability to paddle extensively and with repeated explosive efforts is a limitation, then repeated short duration supra-maximal aerobic efforts (e.g. 110-120% of maximal aerobic speed) may be an appropriate training focus, in order to provide a specific adaptation, without a dramatic addition to the already high paddling volume undertaken by competitive surfers.

**THE INFLUENCE OF STRENGTH AND POWER ON SURFING COMPETITION PERFORMANCE**

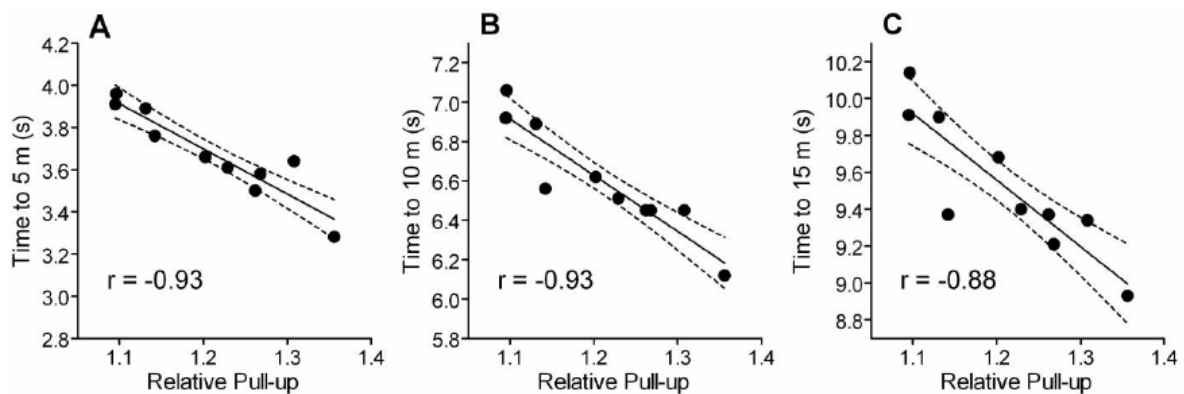
Sport-science analysis can often focus on events that occur most frequently or those which dominate the duration of the competitive time period. It is important to recognize that although wave-riding only accounts for a small portion of surfing competition, it is the component the athletes are judged on. As such, it is vital to examine the demands of wave-riding, which the authors assert is characterized by repeated, explosive efforts, involving multiple cycles of force application and absorption.

To date, little research attention has been paid to examining the potential influence of strength on surfing performance, yet clearly, several possible benefits of increased strength exist for improving surfing performance. Considering the role of upper-body power in swimming (2), it stands to reason that strength of the upper-body and trunk could play a key role in enhancing sprint and endurance paddle performance. The authors have recently found a strong association ( $r=0.66-0.92$ ) between sprint paddling acceleration and top-speed with 1 repetition maximum pull-up strength relative to body-mass (Figure 1 and 2). These results provide an initial basis of rationale for strength training in surfers, to potentially improve paddle performance. Furthermore, strength training of the upper-body could potentially provide increased injury resiliency for surfers who already perform a large volume of paddling in their normal surf training.

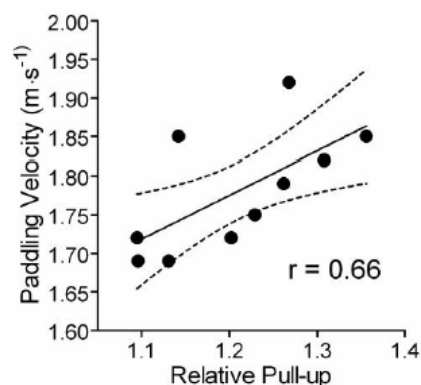
No studies to date have examined lower body strength and power qualities in surfers. Considering the explosive actions undertaken during competitive wave-riding performance, it stands to reason that lower-body strength and power are likely critical factors in determining performance. Competitive wave-riding is characterised by repeated actions of force production and the arresting of force (Video 1), and the authors have observed considerable differences between higher and lower performers in lower body strength and power (Figure 3). As such, the authors assert that once a foundation of technique has been established, training for surfers should involve a considered focus on developing good strength and power performance, including strategies such as maximal strength, ballistic strength and Olympic weightlifting, and plyometric exercise for the upper and lower body.

**Table 1** - A comparison of the Relative Pronated Pull-Up Strength between faster and slower sprint paddlers in a group of competitive surfers (n:10).

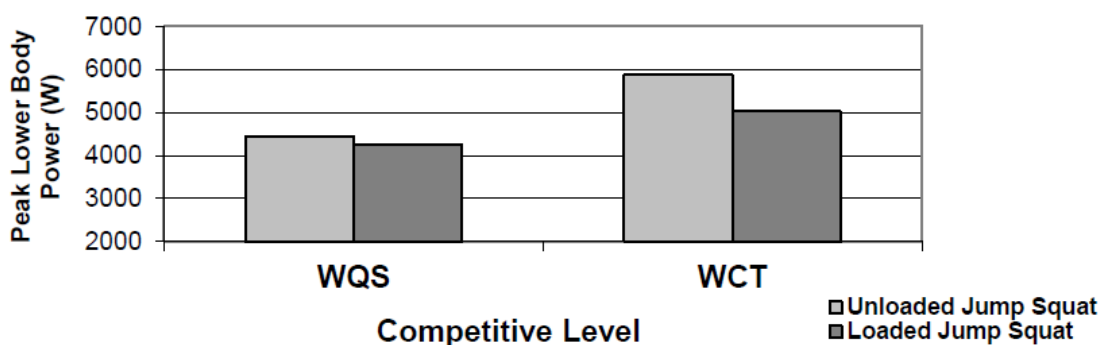
	Faster(n:5)	Slower(n:5)	P value	Effect Size
Relative Pronated Pull-Up Strength (1RM/Body-mass)	1.27	1.15	0.03	1.88



**Figure 1** - The association between Relative Pronated Pull-Up Strength (1RM) and sprint paddling performance for 0-5m, 0-10m, and 0-15m in competitive surfers (n:10).



**Figure 2** - The association between Relative Pronated Pull-Up Strength (1RM) and peak paddling velocity in competitive surfers (n:10).



**Figure 3** - A comparison of a higher-performing (World Championship Tour, WCT, n:1) and a lower-performing (World Qualifying Series, WQS, n:1) surfer with similar age and training background.

## CONCLUSIONS

Although sport-science, and to a large extent, training culture, in surfing is in its infancy, there exists a strong basis of rationale for profiling surfers as athletes, and providing specific strength and conditioning interventions. With the view that physicality underpins technical ability, it is the authors' view that surfers who engage in strength and conditioning will create a greater foundation for advancing technique further. These benefits can be related to performance enhancement for wave-riding and paddling, but also injury prevention considerations (e.g. preventing overuse injuries, decreasing risk of injury in landings and changes of direction).

This is a brief review and is therefore limited in scope. The authors have not addressed other aspects likely related to performance in surfers such as mobility, sensorimotor ability and its potential training aspects, nutrition, recovery and regeneration considerations, etc.

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