

When warming up for the cycling race, less is more

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Coaches, physiologists and athletes alike will attest to the importance of warming up before athletic competition. Warming up increases muscle temperature, accelerates oxygen uptake kinetics and increases anaerobic metabolism, all of which enhance performance. However, the question of how long and strenuous a warm-up should be is more contentious, with some in the sports community advocating longer warm-ups and others espousing shorter ones. Now researchers at the University of Calgary Human Performance Laboratory in Calgary, Alberta, Canada have found evidence indicating that less is more.

In a study comparing the effects of a traditional, intense warm-up with those of a shorter, less strenuous warm-up on the performance of 10 highly trained track cyclists, the researchers found that the shorter warm-up produced less [muscle fatigue](#) yet more peak power output. The findings are captured in the study entitled, "Less is More: Standard Warm-up Causes Fatigue and Less Warm-up Permits Greater Cycling Output," published in the [Journal of Applied Physiology](#). The study was conducted by Elias K. Tomaras and Brian R. MacIntosh.

The Long and Short of It

The intensity of traditional, longer warm-ups has been thought to offer competitive athletes an edge by promoting a process called post-activation potentiation (PAP). In PAP, brief bouts of strenuous physical activity produce a biochemical change in [muscle cells](#) that can enhance

muscle contractile response. The phenomenon usually lasts from 5 to 10 minutes. However, as the researchers note, fatigue can decrease muscle contractile response. Therefore, the team focused analysis on muscle contractile response as well as on another key component of a cyclist's success, peak power output.

In the study, cyclists participated in two warm-ups. A longer, traditional warm-up began with 20 minutes of cycling that gradually increased in intensity until the cyclists reached 95 percent of their maximal heart rates. This general warm-up was followed by four sprints at 8-minute intervals. The entire warm-up lasted approximately 50 minutes total. The shorter, experimental warm-up included a shorter initial ride that increased in intensity until the cyclists reached only 70 percent of their maximal [heart rates](#). This warm-up ended with only one sprint and lasted approximately 15 minutes.

The researchers used specific tests to measure the cyclists' muscle contractile response and peak power output before, during and after the warm-ups. Although they theorized that both warm-ups would elicit PAP, they also theorized that the traditional warm-up would generate enough fatigue to counteract PAP, whereas the experimental warm-up might not. They found that although muscle contractile response decreased more after the traditional warm-up, indicating greater fatigue, there was a decrease in contractile response after both warm-ups. This, according to Tomaras, a co-author, "indicates that an even shorter warm-up might be better for athletes who want to tap into PAP."

The shorter warm-up permitted better performance, as well. Peak power output was 6.2 percent higher and total work was 5 percent higher after the experimental warm-up than after the traditional warm-up, results the researchers say are significant, and could make a substantial difference in competitive events.

Implications

The fitness community has embraced PAP as a competitive strategy in recent years. As word spreads about PAP's benefits, trainers and coaches have attempted to time PAP to coincide with competition. But the Calgary team's findings suggest too much focus on promoting PAP could be self-defeating, as starting the process requires intense, but tiring, bursts of activity. In their conclusion, the researchers write, "A warm-up that is performed at too high of an intensity for longer than necessary can result in fatigue and impair subsequent athletic performance."

Instead, according to co-researcher MacIntosh, "the findings suggest that competitive athletes may reap greater rewards from PAP by engaging in less strenuous warm-up than conventional wisdom dictates. A better approach would be to aim for just enough activity to promote PAP without creating fatigue".

This may be especially true for sprint athletes (cyclists, relay runners, track sprinters, swimmers), whose competition involves several events close together. The researchers conclude, "If warm-up results in fatigue of an athlete and impairs performance in a single subsequent bout of exercise, what impact would it have on multiple performances required on the same day?"

More information: Less is More: Standard Warm-up Causes Fatigue and Less Warm-up Permits Greater Cycling Power Output, Published online before print May 2011, doi: 10.1152/jappphysiol.00253.2011

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