

## Effects of Warm-up on Performance

Warm-up exercise enhances blood flow to the active muscles and increases muscle temperature. Benefits include better oxygen delivery to exercising muscles, improved enzyme function, and increased range of motion. Until recently, little research on the benefits of warming up for equine athletes had been conducted. In the last five years, studies have shown that warm-up can be beneficial and is related to the type of activity the horse will perform.

Trials have compared exercise responses of horses when they received a mild/moderate warm-up or no warm-up at all. In research conducted in Australia (Tyler et al, 1996; *Equine Vet J.*, 28:117) 10 minutes of warm-up (walking and trotting) decreased the oxygen deficit accumulated during a high-intensity sprint to fatigue, compared to no warm-up.

A study conducted by researchers at Ohio State University (McCutcheon et al, *J Appl. Physiol*, 87:1914) found that warm-up reduced the oxygen deficit and the accumulation of lactate during high-intensity exercise. These results suggest that a warm-up performed shortly before high-intensity exercise, such as racing, will enhance oxygen delivery to exercising muscles.

In another experiment published in 1996 (Lund et al, 1996; *J. Appl. Physiol.*, 80:2190), horses had better heat dissipation during intense exercise when they completed a moderate warm-up compared to no warm-up. Heat accumulation in muscles can lead to muscle damage, therefore, enhanced heat dissipation may be beneficial to the equine athlete.

While there is a consensus that a warm-up is beneficial, there is still little information on the most useful warm-up procedure. The best warm-up will prepare the physiological systems, but not contribute to excessive heat accumulation or fatigue. Research in humans has shown that too much warm-up can be worse than no warm-up for certain types of exercise.

Research at the University of Kentucky compared the effects of 13 minutes of mild warm-up (walking) to 13 minutes of intensity-specific warm-up (walk, trot, canter or 20 seconds of gallop) on horses that performed either a high-intensity (near maximal) sprint for 70 seconds or a moderate exercise bout for 210 seconds. The intensity-specific warm-up resulted in reduced lactate concentrations during the 70-second sprint, but not during the moderate exercise bout.

In the study conducted at Ohio State University (mentioned above), a high-intensity warm-up (7 minutes of low-intensity work followed by three 45-second sprints) resulted in earlier fatigue than 10-minute low-intensity warm-up.

These results confirm that some warm-up is better than no warm-up and provide new insight into the types of warm-up that may be the most beneficial. When horses are going to perform a short-distance race, a moderate warm-up

with a brief sprint may be more beneficial than just walking or performing a slow jog. For longer distance efforts, the benefits of warm-up become less clear.

One important consideration in planning warm-up programmes is the environmental temperature. Because some of the benefits associated with warm-up involve an actual warming of the muscles and blood, the amount of exercise required to achieve the same effect may be less when it is hot and more when it is cold. For example, exercise that causes body temperature to increase 2°F in 70-degree weather can cause almost a 4°F increase in hot weather.

To date, research on the effects of warming up on horses has examined metabolic responses. Studies in the future should address effects on tendons, ligaments, joints and neuromuscular function.

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