

# Abstract

While many studies have documented the beneficial effect of intense training on performance, movement economy and muscular adaptations in trained subjects (reviewed in Iaia & Bangsbo 2010; J Bangsbo 2015; Hostrup & Bangsbo 2016), knowledge in certain areas are lacking. Examples on such areas are the effect of: intense training for a prolonged period, intense training performed very frequently, reduced training volume after a period with frequent intense training, and repeating a period of intense training. Thus, the overall aim of this PhD project was to investigate the effect of different compositions of intense training on performance, movement economy and muscular adaptations.

The findings from the present PhD study suggest that performing intense training, in the form of speed endurance training (SET), for a relatively short period improves short and long-term performance. Both a prolonged period of SET as well as a period with increased frequency of SET improves short-term performance further, but a prolonged period does not extrapolate to further improved long-term performance not even if SET frequency is doubled. Short-term performance was better after 16 days of reduced training volume (tapering) compared to before the period with increased frequency of SET, which supports the idea of an overload phase combined with a tapering phase to improve short-term performance. 8 days of tapering was sufficient to improve 10-km performance, but since performance was not better compared to before the period of increased frequency of SET, the value of combining an overload phase with tapering to improve 10-km performance is low. In line with the literature on "muscle memory", performing a second intervention of SET and a basic volume of aerobic training might have a greater impact on short-term performance than the initial intervention, while the initial gain in 10-km performance is of the same magnitude. Changes in short-term performance were found together with muscular adaptations of importance for the development of fatigue with specific changes in the expression of  $\text{Na}^+/\text{K}^+$  pump isoforms and proteins related to  $\text{Ca}^{2+}$  re-uptake. The changes in 10-km performance were associated with improved running economy and anaerobic capacity, thereby blueprinting the relevance of intense training for long-term performance.

Collectively, these findings indicate that short-term performance does continuously improve with different compositions of intense training, probably due to the specificity of the training stimuli. Furthermore, that the gain in 10-km performance, which is associated with improved running economy, is obtained relatively swiftly (after only ~10 sessions of SET), suggesting that 10-km runners only need to do SET in the last 40 days before a competition.