



DON'T OVERESTIMATE THE POWER OF THE FORCE

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Muscular power depends on force-velocity, activation, and deactivation characteristics, all of which adapt to training. Resistance training programs intended to improve power have produced mixed results. We used previously reported data from heavy and explosive training programs [1,2] to modify muscle-tendon model parameters and evaluated power during cyclic contractions.

Heavy training greatly increased force (26.8%) but also increased time required for activation (20%) and deactivation (48%). Explosive training produced smaller improvements in strength (10.8%) and reduced time required for activation (20%) and deactivation (10%). Both programs led to similar increases in maximum power (13.5% for heavy and 14% for explosive) but with different power-frequency relationships (Figure 1). Heavy training produced maximum power at lower frequencies (1.6Hz) typical of swimming and speedskating, whereas explosive training produced maximum power at higher frequencies (2Hz) typical of sprint running and cycling, and balance recovery. Greater deactivation time (due to heavy training) compromised power by requiring earlier stimulation offset leading to reduced positive power production as well as the prolonged deactivation led to increased negative power during lengthening (Figure 2). These modeling results demonstrate the importance of activation and deactivation during cyclical contractions, particularly at higher frequencies. This underscores the importance of both strength and deactivation for power during cyclic contractions.

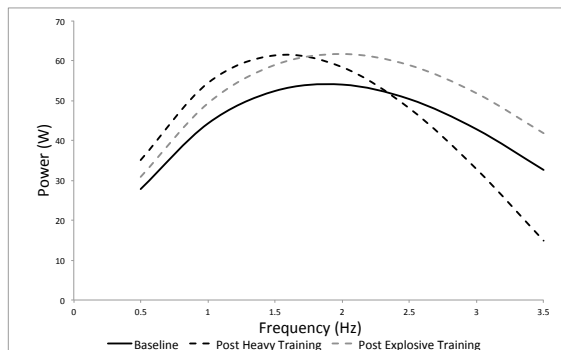


Figure 1: Maximum power-frequency relationships.

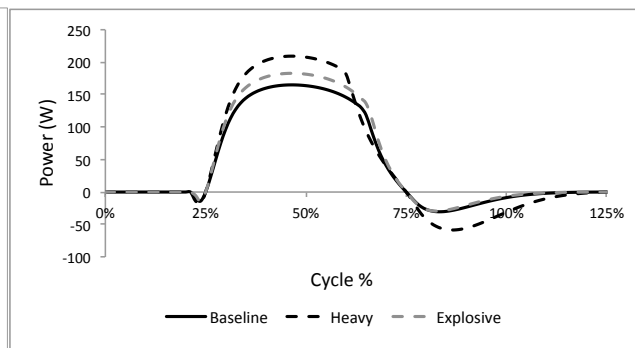


Figure 2: Optimized power production for one shortening-lengthening cycle at 2 Hz for each scenario.

References

- [1] Hakkinen et al. (1985). *Acta Physiol Scand*, **125**: 573-585.
- [2] Hakkinen et al. (1985). *Acta Physiol Scand*, **125**: 587-600.
- [3] Bezodis et al. (2008). *Med Sci Sports Exerc*, **40**: 707-715.
- [4] Han and Yang (2015). *Hum Mov Sci*, **44**: 192-202