The Value of Aerobic Exercise for Recovery & Learning New Skills for the College Athlete

Neural Plasticity
- The capacity of the nervous system to modify its organization to altered demands and environments

Brain Derived Neurotrophic Factor (BDNF)
- Major neurotrophin for neural plasticity
- A protein found in high concentrations within the central nervous system primarily within the specific brain regions of the hippocampus, cerebral cortex, hypothalamus, and cerebellum
- BDNF can cross the blood-brain barrier and can be found throughout the body and stored within tissues
- BDNF is one of the main neurotrophins responsible for neural development and functioning which includes neurogenesis, dendritic growth, and long term potentiation of neurons

BDNF & Aerobic Exercise
- BDNF can increase during a single bout of aerobic activity by roughly 30%
- Submaximal Aerobic activity releasing BDNF signaling from the brain stem positively regulates parasympathetic neurons which can result in a reduction of heart rate via vagal and parasympathetic tone
- Increasing parasympathetic tone can aid in recovery from highly stressful activities such as games, practice, school, etc
- BDNF is the primary neurotrophin involved in the survival and maturation of parasympathetic neurons
- BDNF is shown to protect neurons against oxidative, metabolic, and excitotoxic stress
- Endogenous BDNF production and signaling protects neurons against adverse conditions associated with acute injury

1 Dan Hechler
Northeastern University Assistant Strength & Conditioning Coach

Fig 1. Physiological mechanism proposed for how physical exercise attenuates inflammation (Papathanassoglou et al. 2015)
Aerobic Activity & Cognition

- Aerobic training increases the “prerequisites” for learning by increasing neurotrophin release specifically BDNF which is necessary for neuroplasticity.\(^3\)
- Higher BDNF levels are associated with better spatial, episodic, recognition, and verbal memory as well as hippocampal functioning.\(^2\)
- Combining aerobic work with the teaching of new tasks afterward can potentially enhance the retention of the task due to increased BDNF levels.\(^3\)
- Exercise-induced BDNF release can reduce the threshold for successful encoding and memory which has been hypothesized to put the brain in a state of readiness for plasticity or “learning.”\(^2\)
- Exercise-induced BDNF release can reduce the effects of detrimental stressors specifically oxidative DNA changes and disruption of synaptic plasticity from sleep deprivation. This is important for athletes who go through a lot of oxidative stress via games, practice, training, etc and generally have suboptimal sleep patterns.\(^7\)

Fig 2. Possible relationship between physical exercise, neuroplasticity, and cognition with moderator factors (Hötting, K., & Röder, B. 2013)
References


