Aerobic exercise in major psychiatric disorders: promises and challenges

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Cognitive deficits, specifically in episodic and working memory, and structural deficits like hippocampal volume reduction are hallmarks of an unfavorable outcome in schizophrenia and affective disorders. These features develop early in the course of the illness and cognitive deficits are difficult to treat with current pharmaceutical options. Recent evidence suggests that volume reduction in the hippocampus correlates with episodic memory deficits in schizophrenia [1]. Aerobic exercise comprising endurance training alone or in combination with cognitive training was demonstrated to increase hippocampal volume, *N*-acetyl-aspartate/creatinine ratio, to improve episodic memory in schizophrenia patients and working memory in major depression [2–4] and thus is promising to contribute to recovery. However, our subsequent study in a larger cohort of chronic schizophrenia patients that combined endurance training with cognitive remediation for a period of 3 months did not replicate hippocampal findings, but found the volume of the left temporal cortex to be increased [5].

The questions which disease-related environmental or genetic factors may inhibit neuroplastic changes in the hippocampus or other brain regions during aerobic exercise and impact on severity of neuropsychological deficits in individual patients need to be answered. In addition, other neurobiological mechanisms of aerobic exercise, e.g., on neurogenesis, neurotransmitter systems and stress-related hormones, have to be identified in major psychiatric

disorders. In this issue, Carneiro et al. report that in women with depression, add-on aerobic exercise had no effects on cortisol and monoamine levels [6]. Feasibility and physical adaptations to endurance training have been shown in patients with severe psychiatric disorders such as chronic schizophrenia. However, these patients did not show significant adaptations in energy metabolism measured as power at fixed levels of lactate concentrations. This reduced ability to increase efficiency of aerobic energy metabolism or reduced adaptation potential may be explained by impaired functions of mitochondria [7]. A meta-analysis of exercise interventions in schizophrenia indicated that improvement of symptoms occurs with a higher intensity of training [8]. However, the optimal training intensity and duration of training in major psychiatric disorders are yet to be defined. In a small group of patients with different psychiatric diagnoses that included schizophrenia patients, a short period of an 8-week high-intensity interval training did not decrease psychopathological symptoms, but increased physical fitness and improved anxiety [9]. High-intensity training may have a higher potency than conventional endurance training to improve cognitive deficits, negative symptoms and metabolic parameters in major psychiatric disorders, but neuroplastic changes in the brain need to be identified. In addition, benefits of muscle strength training on neurocognition have not been investigated, but first results indicate improvements of mood and anxiety [10] and thus positive effects on symptom severity are to be expected. Future studies will disentangle mode and intensity of add-on aerobic exercise training needed to improve recovery in major psychiatric disorders.

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