# Exercise may protect nerve cells in Spinal Muscular Atrophy patients

March 4 2016

Long-term exercise appears to be beneficial for Spinal Muscular Atrophy (SMA) like mice, suggesting a potential of active physiotherapy for patient care; according to a study published today in the *Journal of Physiology*.

A 10-month training programme improved muscle resistance to activity-induced damages and increased aerobic performance in mice. While swimming and running was both beneficial for motor neurons affected by SMA, different types of exercise had an impact on different motor neurons and muscle fibers. Swimming protected intermediate and fast motor neurons (the most affected type of motor neuron in SMA), and enhanced the cross-sectional area of large muscle fibers, while running only protected slow motor neurons and enhanced the cross-sectional area of intermediate muscle fibers .

Physical exercise is known to induce benefits in some neurodegenerative diseases, including Parkinson's disease, but its benefits in other diseases such as Amyotrophic Lateral Sclerosis and Duchenne Muscular Dystrophy, remains controversial and highly debated for its routine use in patient care. SMA is a neurodegenerative disease and the leading genetic cause of childhood death. It affects neurons involved in movement (motor neurons) and leads to progressive muscle weakness and atrophy. There is currently no cure for SMA and potential benefits of exercise in patients with SMA have not yet been investigated.

'Physical exercise' is a term that covers a wide range of very different

conditions, including long-term vs acute exercises, concentric vs eccentric contractions and power vs endurance exercises. Therefore, the type of exercise could be the key in understanding the apparently contradictory effects of exercise in a given disease.

For their study, researchers used transgenic SMA-like mice as well as a control group of mice (68 mice per group). For 10 consecutive months, 5 days/week for 10 min /day, the mice had to perform either a low intensity running exercise (favouring the use of oxidative energetic pathways) or a high intensity swimming exercise (favouring the use of anaerobic energetic pathways). Throughout the 10-month training, they evaluated morphological and behavioral adaptations, as well as the physiological adaptations.

Olivier Bondi from the Université Paris Descartes and main investigator of the study explained,

'So far, the clinical care strategy for SMA patients has been based on symptomatic alleviation and physiotherapy. Active exercise has previously been avoided to minimise damage to muscles and neurons.

'Our study shows, though, that not only could physical exercise be part of a cheap, beneficial long-term care programme for SMA patients (especially compared to pharmacological approaches and walking aids), it also highlights the importance of defining a specific exercise regimen to limit the neurodegeneration process.

'Our research could provide several clues when designing rehabilitation programs for SMA patients; and the findings have already been used to design an innovative clinical trial for SMA patients in France (ExerASI, n° ID RCB 2013-A01331-44).

'This shift in patient care towards the prescription of appropriate

exercise in neuromuscular disorders could profoundly change the view of physiotherapy in SMA but also for other neuromuscular disorders. Understanding the mechanisms of exercise-induced benefits in neuromuscular degenerative diseases could provide a platform for discover new potential pharmacological approaches in such patients.'

**More information:** Farah Chali et al. Long-term exercise-specific neuroprotection in Spinal Muscular Atrophy-like mice, *The Journal of Physiology* (2016). DOI: 10.1113/JP271361