

Age-related cognitive function decline is often accompanied by the deterioration in the brain structures. What is more, normal aging also entails slow and continuous loss of muscle mass and its function defined as “sarcopenia”. Thus, age-associated brain and muscle deterioration causes loss of cognitive and mobility efficiency of the elderly.

A growing number of human studies suggest that regular physical activity can improve not only physical but also mental health.

It is well-known that physical training leads to the increase of strength, coordination and stability not only by improving the neuro-muscular mechanism, but also by increasing muscle mass. Moreover, muscle mass has been demonstrated to act as a secretory organ, releasing proteins (myokines) into the bloodstream during contractions. Among the many exercise-released molecules, some are characterized as inflammatory, while others have anti-inflammatory and neuroprotective properties. Differences in the production and release of pro- or anti-inflammatory proteins correspond to the type, duration, time and intensity of exercise. Therefore, searching for suitable, effective dose of physical exercise seems to be crucial.

Recent human neuroimaging studies also show that chronic exercise leads to increased gray and white matter volume and enhanced cognitive functions. These effects likely result from increases in above mentioned anti-inflammatory and neuroprotective-like proteins. The end result of these structural changes is a better interconnected brain that is more plastic and adaptive to change.

Most interventions are based mainly on continuous-aerobic mild to moderate intensity exercise, which requires people to make a sufficient time commitment. Such kind of exercise is often reported as less enjoyable and boring, which is known as a limiting factor. Given the markedly lower training volume, interval training is a time-efficient strategy inducing rapid muscle and cardio-respiratory adaptations. Therefore, interval training has been successfully applied in many health-oriented programs focusing on the prevention of metabolic and cardio-respiratory diseases. Interestingly, our current research indicates that acute aerobic transferable interval training is an effective way to improve the cognitive function among young people. Nevertheless, people trying to begin physical activity often encounter several problems related to their current health state (limited mobility) which limits the performance of aerobic exercises and/or to the availability of sports infrastructure (distance or financial costs). To address the limitations of aerobic exercise protocols and provide an effective and efficient program for older participants, we have modified the American College of Sport Medicine interval exercise program – a high intensity circuit training. When body weight is used as resistance, it eliminates the limiting factors of access to equipment, facilities and reduces mobility requirements. It could also deliver numerous health benefits in much less time than traditional aerobic exercise programs.

However, studies verifying the impact of chronic interval training protocols on brain and cognition among the elderly are limited.

In this project we plan to verify the impact of the different (aerobic and resistance) acute and chronic interval training protocols on brain structures and functions, as well as on physical capacity among the elderly. The impact of the myokines, cytokines and neuroprotective proteins released during exercise on human cognitive functions will also be verified. What is more, we would like to simplify to the extent possible the interval training programs and make them easier to perform, as well as more attractive for elderly people.

Reducing the global economic burden associated with the aging population is critical, given that the social cost of dementia in the European Union almost matched the combined costs of cancer, cardio-vascular disease, and diabetes. Urgent implementation of effective countermeasures is critical to fully prepare for the challenges of the world’s changing demographics.

Since there are no curative treatments currently available, major efforts need to focus on prevention, with emphasis on modifiable risk factors such as engagement in physical activity. Ability to preserve cognitive functions (related to the functioning of the brain), as well as mobility functions (related to the functioning of the muscles), will allow elderly people to maintain an independent and dignified life.