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Physical exercise and dementia

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SUMMARY ENGLISH

In the current thesis the main objective was to study the role of a controlled combined aerobic and strength training program in reducing the rate of cognitive and motor decline in patients with dementia who live in a nursing home. Furthermore, the effects of exercise on activities of daily living (ADL) were studied.

Chapter 1 described the predicted exponential growth in the number of patients with dementia in the upcoming decades. With the recent recognition that 'exercise is medicine', physical exercise is introduced as an effective non-pharmacological alternative to slow down the cognitive and physical deterioration in patients with dementia but without the side effects as seen in current pharmacological treatments. We hypothesized that an alternating form of aerobic and strength training leads to improved motor function. Furthermore, we expected that improved motor function mediates improvements in cognitive function. Together, the improvements in both motor and cognitive function, elicited by the combined exercise program, could translate into improved ADL. ADL is known to have a large impact on the quality of life in patients with dementia.

In **chapter 2** a systematic review gives an overview of the most frequently used neuropsychological and physical tests in randomized controlled trials in patients with dementia. A recommended set of neuropsychological and physical exercise tests was presented. However, more clinimetric and feasibility research, specifically in patients with dementia, is needed.

As a first step to counter the limited number of feasible and reliable measurement tools for patients with dementia, **chapter 3** described the development of a new dynamic walking test; The Groningen Meander Walking Test. This test was specifically tailored to the abilities of patients with dementia and was found feasible and reliable. Based on the findings in that study it was concluded that critical features for a feasible test choice and test development in patients with dementia should include (1) a small number of instructive steps per task, (2) a short duration per task, (3) no repetitive instructions during task performance.

Prior to a large scale randomized clinical exercise trial in patients with dementia, a pilot study was done to investigate the feasibility of performing a combined aerobic (i.e., walking) and strength training program in patients with dementia. **Chapter 4** showed that it is feasible to conduct such an exercise program. Furthermore, the results showed promising motor and cognitive benefits. Together, these findings served as a basis for a large randomized clinical trial.

A large randomized clinical trial was described in **chapter 5**. The aims were (1) to compare training and follow-up effects of combined aerobic and strength training and aerobic-only training on cognitive and motor function, and (2) to explore

whether improvements in cognition were mediated by improved motor function. Results showed that the combined exercise group, compared to the non-exercise control group, scored higher on tests for global cognition, visual memory, verbal memory, executive function, walking endurance, leg muscle strength, and balance. The aerobic-only group, compared to the non-exercise social group, scored only higher on executive function. Strikingly, nine weeks after the intervention was ended a large part of the training effects reversed towards baseline. Finally, we could not confirm the hypothesis that improved motor function significantly mediated improved cognitive function. Future research is warranted to study the underlying mechanistic (e.g., neurobiological) association between exercise and cognition in patients with dementia.

Results in **chapter 6** showed that, compared to aerobic-only training, a combination of aerobic and strength training was superior in improving proxy-reported and performance-based ADL. The mediation analysis in chapter 6 showed that exercise intervention-induced improvements in global cognition significantly mediate the improvements in proxy-reported ADL. Furthermore, improvements in walking endurance and leg strength significantly mediate improvements in performance-based ADL. We recommend that future exercise intervention studies should combine aerobic and strength training to effectively improve ADL in patients with dementia.

In **chapter 7** we concluded that a combination of aerobic and strength training is superior in delaying the cognitive and motor decline in patients with dementia, compared to aerobic-only training or no training. Moreover, a combination of aerobic and strength training led to improvements in ADL. These ADL changes were mediated by improved cognitive and motor function after combined exercise. The fact that a large part of follow-up measures for cognitive and motor function returned to baseline underlines the importance of structural exercise programs in daily care in patients with dementia. In addition to a physically active and healthy ageing lifestyle in patients with dementia (e.g., helping with household tasks, gardening, walking to the bathroom), exercise programs can play an important role. We strongly recommend that physical exercise programs include both components of regular aerobic and strength training.