主論文の要旨

Effect of various exercises on frailty among older adults with subjective cognitive concerns: a randomised controlled trial

（主観的な認知機能低下のある高齢者に対する運動介入がフレイルへ与える影響：無作為化比較試験）

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【Introduction】

Frailty has been widely shown to be associated with poor health outcomes, including falls, disability, hospitalization, institutionalization, and mortality in the elderly. Physical exercise has demonstrated additional benefits for reducing frailty but there is insufficient beneficial evidence of exercise in older adults at risk for cognitive impairment. In addition, the optimal types of physical training for older adults with subjective memory impairments have not been established. Therefore, the study aimed to investigate the effects of aerobic training (AT), resistance training (RT), and combined training (AT+RT) programs in community-dwelling older adults with subjective cognitive impairments.

【Methods】

A single-blind randomized controlled trial was conducted to investigate the effects of physical training on reducing frailty in Toyota, Japan. Residents aged between 65 and 85 years were screened using the Kihon checklist; those with subjective cognitive complaints were invited for eligibility assessment. A total of 415 community-dwelling older adults were enrolled and randomly assigned to AT group, RT group, AT+RT group, or the control group. The 40-min core AT program consisted of a 10- to 15-min step-in-place exercise, a 10- to 15-min walking workout, and rest intervals between training sets. The 40-min core RT program included two components: resistance-band workouts and bodyweight exercises. Resistance-band workouts using two elastic bands of different tensions comprised bicep curls, chest presses, side raises, seated rowing, leg presses, hip abduction, and side bends. Combined AT+RT training consisted of RT followed by AT, with the same intensity but half the training time (20 min for each). Participants in the intervention groups underwent a group training program and self-paced home training for 26 weeks. The control group received lectures about health promotion.

A 95-item frailty index (FI) including 6 components was utilized to determine the effects of training at week 26 and week 52. The depression and anxiety component was measured with the Geriatric Depression Scale-15 and the Generalized Anxiety Disorder-7 scale. The functional component was measured with the fall efficacy scale. The physical component was measured with skeletal muscle mass index, unintentional weight loss (2 kg in the last 6 months), weakness, slow walking speed (<1 m/s), and low physical activity according to the Japanese version of the Cardiovascular Health Study criteria. The disease component included 11 age-related chronic diseases. The cognition component was measured with the Everyday Memory Questionnaire, MMSE, Logical memory I&II (WMS-R), category fluency test, letter fluency test, Digit symbol (WAIS-III), and Trail making test-part A&B The quality of life component was measured with the life satisfaction index. Total FI scores were constructed by dividing total deficit values (determined by the severity of each deficit) by the total number of included items.

【Results】

At baseline, mean age of all participants (47% women) was 72.3±4.6 years, with mean FI score of 0.3±0.1.

Compared with the control group in the unadjusted analysis, the AT group showed reduced FI by −0.024 (p=0.02) at week 26. In the model adjusted for age and sex, participants in the AT group still showed reduced FI at week 26 (mean difference −0.020, CI −0.039 to −0.001, effect size −0.275) but not at week 52 (Figure 1). No significant differences in FI were found in RT and AT+RT groups at week 26 and 52. Regarding changes in FI components, AT reduced the depression and anxiety component of the FI at week 26 by −0.051 (CI −0.084 to −0.018, effect size −0.469) after adjusting for age and sex; however, there was no significant change in any component of FI at week 52.

In subgroup analysis, when divided into two groups by frailty severity at baseline (FI≤0.21 and >0.21), results showed that only participants with FI more than 0.21 benefited from AT (mean difference −0.024, CI −0.045 to −0.002) and RT (mean difference −0.030, CI −0.054 to −0.006) at week 26. Additionally, when divided by cognition at baseline, AT demonstrated improved FI at week 26 (mean difference −0.024, CI −0.044 to −0.004) in participants without mild cognitive impairment.

【Discussion】

Our findings suggest that AT potentially reduce frailty by a small extent, especially in the depression and anxiety component. However, our results failed to demonstrate the AT effects on other FI components. The major difference from other studies was that target training duration was titrated to 150 minutes per week in other interventional studies, which was 30 minutes longer than that in our protocol. On the other hand, as more evidence suggested the combined benefits of nutritional support and exercise training, exercise alone is unlikely to be sufficient to reduce frailty. The present study suggested that the multifaceted frailty intervention with a longer training duration might yield greater improvements.

Contrary to our hypothesis, RT and AT+RT failed to decrease FI scores. One reason is that the 40-min core training time might be insufficient to build muscle and improve frailty. Moreover, the transition time between AT and RT sessions in the AT+RT group reduced the total training period, which could diminish the effects of training. The complexity of practicing both training types may compromise the effects of training, especially for participants with memory concerns. Another possible explanation is that the RT was designed to adapt to real-life settings with minimal equipment. The intensity and duration of resistance-band and bodyweight exercises may be not strong enough to achieve detectable improvement in physical performance. To balance the beneficial and adverse effects (e.g., muscle ache and pain) induced by exercise, future studies are warranted to

determine the optimal type, intensity, duration, and frequency of individualized home-based training for older adults with memory concerns.

There are several additional limitations to this study. First, three screening questions in the Kihon checklist may not be sufficient to identify all subtypes of subjective cognitive impairment. Second, a lack of data on exercise habits at baseline and daily self-training records at home meant we could not assess exercise adherence and self-motivation during and after the intervention program. Finally, a physical intervention, instead of an integrative approach including nutritional support, might have limited effectiveness and validity for improving frailty.

【Conclusion】

A 26-week aerobic training reduced frailty modestly, especially in the depression and anxiety component, in older adults with subjective cognitive concerns.