

Proposal for construction of a dynamic multi-dimensional integrated assessment system for exercise and brain health

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Gait performance and walking performance

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| Walking tests | 6-MWT, 12-MWT, 30 min walking test (treadmill, field) |
| Test parameters | <ul style="list-style-type: none">• Walking distance• Gait speed, gait length, gait width, walking rhythm,• cf PWV• Resting BP, BP and BPV during and post exercise (5min)• Resting HR, HR and HRV during and post exercise (5min) |

Gait performance and walking performance

Foundations:

- Association between walking endurance and cardiovascular health
- Gait performance is associated with both cardiac and cerebral health
- Central arterial performance and BPV are correlated. They are also associated with both cardiac and cerebral health.

Background:

- 6-MWT originates from cardiovascular rehabilitation. 6-MWT is a standard test for patients with CAD, heart failure, and COPD.
- No standards of walking capacity in healthy adults.
- People with different stages of type 2 diabetes, high BP, pre-hypertension, hypertension, atherosclerosis may have various levels of injury in cardiac and cerebral health, deterioration in central arterial stiffness. 6MWT is not a sensitive tool for walking performance in these conditions.

Gait performance and walking performance

Applications:

- Walking tests from 6 MWT, 12-MWT, 30min walking are applicable to the majority of adults with or without chronic diseases.
- As a result, we could establish the standards of comprehensive walking performance in healthy population.
- The standards would provide a clear framework, helping to identifying those at risk, track the progression of chronic diseases and effectiveness of therapies.

Exercise test for CBF and cardiac health

Exercise protocol:

- 5-min warm-up
- 30-min aerobic exercise in cycle ergometer
- 50-60%HRR
- 30 min post exercise recovery

Test parameters:

- Exercise BP, BPV, BP and BPV post exercise,
- Exercise HR, HRV, HR and HRV post exercise
- Central arterial properties
- CBF during and post exercise
- 30-min METs
- Cardiac and brain health ...

Exercise test for CBF and cardiac health

Goals:

- A standard exercise testing model for cardiovascular and cerebral-vascular response and adaptation
- Standards for evaluation, tests, treatment and exercise training for aerobic exercise performance and energy metabolism in adults with or without chronic diseases

Reasons:

- Safety and reliability: Moderate-intensity aerobic exercise for 30 minutes is safe, reliable, beneficial for healthy adults and those with chronic diseases
- Feasibility: 30 min bicycle training is feasible in daily life, and clinical settings.
- This exercise test protocol could be progressively and systematically upgraded and improved according to evolving needs, research findings and technology advancements.

Exercise test for CBF and cardiac health

Potential applications for 30-min exercise test

- CBF during and post exercise in healthy adults, which could provide screening references in the prevention and treatment for cerebrovascular, cardiovascular diseases.
- Potential association between central arterial stiffness and CBF
- Exercise safety screening of cerebral health in Cardiac Rehabilitation

- Cardiovascular and cerebrovascular responses and adaptations based on the results of CBF, BPV, HRV during and post exercise

- BPV during and post exercise and CVD risk (this result aims to prove that the greater magnitude of BPV and MAP change during exercise may impair dynamic cerebral autoregulation)

Exercise test for CBF and cardiac health

Potential applications for 30-min exercise test

Potential application of establishing 30-min cycle ergometer exercise as a routine and formal tool for evaluation and testing:

- 30-min energy metabolism of aerobic exercise for healthy adults, which may differentiate those with chronic diseases
- Establish the potential association of 30-min METs with corresponding $\text{VO}_{2\text{peak}}$
- The results of 30-min METs, CBF, and cardiovascular and cerebrovascular responses (BP, HR) from healthy adults could be established as the references from those with chronic diseases