PROTOCOL

Title:

Intra-rater reliability and agreement between static balance test using Nintendo Wii Balance Board and gait test under dual-task conditions in community-dwelling older adults.

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Authors: Martin E [1,2], Jens[1,2]/Gustav[1,2], Martin J [1], Stig[1,2], Jens[1,2], Gustav[1,2]

Affiliations:

1. **Department of Geriatric Medicine, Aalborg University Hospital, Aalborg, Denmark**
2. **Department of Clinical Medicine, Aalborg University, Aalborg, Denmark**

Background:

Falls are a major concern for healthcare systems globally and for many older adults. To prevent falls, screening for falls risk followed by intervention on relevant risk factors is important[15]. Numerous falls risk factors have been described in the literature [16], and recently, an increasing interest have evolved around the link between mobility and cognition [2, 8]. In continuation hereof, prior studies have demonstrated an association between executive dysfunction, especially when dual-tasking, and falls [8,17]. Thus, a recent consensus statement has recommended testing for the ability to dual-task when walking [2]. However, practical obstacles may be involved when trying to apply this test on older adults. For instance, the dual-task gait test requires space for a walking path, along with the older adult having sufficient dynamic balancing capabilities to walk unassisted. To optimise recruitment of older adults, the possibility to conduct studies in their homes have shown to be important [18, 19]. Notably, a previous study found measuring of static balance, using a Nintendo Wii Balance Board (NWBB) within this setting feasible [20]. This study will examine whether dual tasking using the NWBB static balance test can be considered a suitable alternative to the dual-task gait test.

Objectives:

This study aims to assess agreement between, and 1-week intra-rater reliability of, the dual-task gait test and the NWBB static balance test in community-dwelling older adults (≥65 years).

Study design:

Cross-sectional study comparing two dual task tests; the NWBB test and the gait test.

Methodology:

Participants: We aim to recruit 30 participants aged 65 years or abovethrough convenience sampling at an senior activity centre in the Municipality of Aalborg. Inclusion critiria is age about 65, the ability to stand for 30 seconds without any aid and the ability to walk 8 meters. Exclusion critiria is dementia as this might affect the cognitive results. Activity centres tend to allure seniors with good physique, hence, there is a risk of selection bias using this type of sampling. We will try to minimize this risk by recruiting widely from the activity center and not only from the physical teams, i.e. gymnastics [12].

Setting and data collection: Testing will be performed at the activity centre on the NWBB [21] and the gait test on 8m [5] of hard floor without carpets or obstacles. Data will be registrered in REDCap [22].

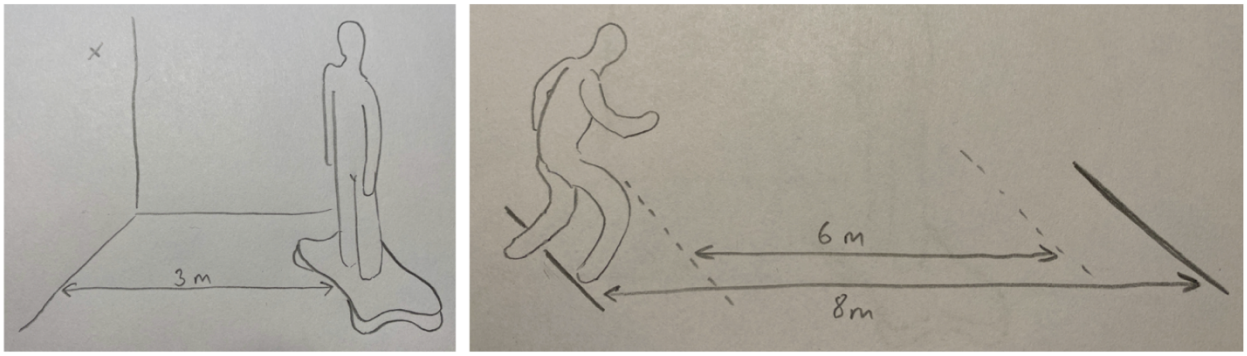

Figure 1. Drawing of WBB and gait test settings.

Procedure: The participant will attend two test days separated by 14 days. At the initial test day, participants will complete the Orientation Memory Concentration (OMC) test [23] and fill out a questionnaire to inquire baseline characteristics. The questionnaire include the Tilburg Frailty Scale (TFI) [24], Vulnerable Elders Survey 13 (VES- 13)[25], the Short Falls Efficacy Scale International [26] and questions regarding musculoskeletal complications, neurodegenerative diseases or complications, and use of medicines [3] [6] [7] [11]. Afterwards, participants will undergo the testing procedure includingsingle-task cognitive tests, single-task and dual-task gait , and single- and dual-task NWBB tests in a counter-balanced order

The cognitive tests include a supermarket test [27], an arithmetic test [2], and an animal test [2]. Each participant will complete three trials of 30 seconds of each test for a total of nine trials. The single-task gait test includes three trials of eight-meter walking, with the middle six meter being timed. During the single-task NWBB test, participants will be instructed to stand as still as possible for 30 seconds on a WBB for three trials. For the dual-task tests, the participants will perform the gait and NWBB conditions while carring out the before-mentioned cognitive tests simultaneously. Thus, the participants will conduct nine dual-task gait and NWBB tests, respectively. An overview of the testing procedure is provided in Figure 2.

At the second test day, the participants will perform the testing procedure again including the single-task cognitive test, the single- and dual-task gait test, and the single, and dual-task NWBB test. The order of the test will be identical to the order on the initial test day.

		COGNITION			
		Supermarket test	Arithmetic test	Animal test	No cognitive (singe task)
TESTS	Cognitive test (single task)	1. Butcher products 2. Fruits & vegatables 3. Dairy products	1. 480 – 7 2. 420 – 7 3. 450 – 7	1. Birds 2. On land 3. Sea animals	
	Gait test (dual + single)	1. Dairy products 2. Butcher products 3. Fruits & vegatables	1. 220 – 7 2. 250 – 7 3. 280 – 7	1. On land 2. Sea animals 3. Birds	1. Time 1 2. Time 2 3. Time 3
	WBB test (dual + single)	1. Fruits & vegatables 2. Butcher products 3. Dairy products	1. 350 – 7 2. 320 – 7 3. 380 – 7	1. Sea animals 2. On land 3. Birds	1. Area + speed 1 2. Area + speed 2 3. Area + speed 3

Figure 2. Schematic overview of this study's tests.

Analysis: Data will be used for calculating the correlation between the gait test and the NWBB test using correct response rate (CRR) [8], dual task gait/balance cost (DTGC) and dual task cognition cost (DTCC) [7]. Agreement will be investigated through Bland-Altman plots [13] along with calculation of mean difference, paired t-test, and LOA. Correlation will be shown using Pearson's correlation. Analysis of intra-rater reliability will include interclass coefficient (ICC), coefficient variant (CV), limits of agreement (LOA), standard error of measurements (SEM) and mean difference including paired T-test.

Safety considerations: Participants will be followed closely through the gait test and the NWBB test. If participants are unable to walk 12x8m or unable to keep their balance for 12x30sec the investigator will interrupt the testing and they will be excluded from the study for safety reasons. Smaller breaks and single fails are accepted.

Reproducibility: The study is easily reproducible. Participants represents a wider part of the background population between elders above 65yo. Testing only includes a WBB and 8m of firm flat floor without obstacles.

Ethics: Participants will participate voluntarily with oral and written consent. The local ethics committee will have consulted, and the study will be registered at the Danish Data Protection Agency.

Time schedule:

Testing will be conducted throughout November 2020, and the study result will be presented as an article in 2021.

Funding:

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Conflict of interests:

Investigators in this project has no economical or any other partial interests. One of the employees in the research team at the geriatric department is a co-owner of the software Fysiometer, which is used for data collecting from the WBB, however, he will not participate in any of the data collection or subsequent analyses.

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