CHAPTER 3

METHODS

3.1 Participants

Seventy-five Thai older adults aged 65 years old or older were recruited through flyers in the surrounding communities.

3.1.1 Inclusion criteria

1. Able to walk at least 10 meters without any assistive device

2. Able to follow simple instructions based on cut-off point of the Mini-Mental State Examination-Thai 2002, (Appendix A)

3.1.2 Exclusion criteria

1. Severe neurological problems that could account for possible imbalance such as cerebral vascular accident, Parkinson's disease, transient ischemic attacks, and neuropathy

2. Severe musculoskeletal problems that could impact on gait such as severe osteoarthritis, and active inflammatory joint disease

3. Severe cardiopulmonary problems such as asthma, and Chronic Obstructive Pulmonary Disease

4. Uncorrected visual impairment

5. Severe auditory impairment such as hearing loss

6. Taking alcohol 6 hours before testing

The study was approved by the Faculty of Associated Medical Sciences research ethic committee and written informed consent was obtained form each participant prior being enrolled into the study.

3.2 Outcome measures

3.2.1 A general questionnaire: a general questionnaire was developed to include demographic information (i.e. age, education level, sex and body mass index), health status (i.e. physical activity, neurological disease, major musculoskeletal problem, cardiovascular disease, visual impairment, medication use), as well as history of fall in the past year, and history of imbalance in the past year (Appendix B).

3.2.2 The Attention Network Test: The Attention Network Test (ANT) has been used to evaluate the attention networks, which include alerting, orienting, and executive attention. Alerting attention is the ability to achieve and maintain an alert state, whereas orienting attention is the ability to select information from sensory input. Finally, executive attention is the ability to resolve conflict among responses (38) (Appendix C).

The ANT consists of four blocks. The first block is the practice block and it takes about two minutes. The other three blocks are the experimental blocks and it takes about five minutes each block. The participants may take a short break between blocks. The entire test took approximately twenty minutes to finish (38).

3.2.3 The Ability to allocate attention: The priority costs (i.e. gait-priority cost and cognitive-priority cost) were used to indicate the ability to shift attention. The gait-priority cost was calculated from (P-N)/N, where P referred to the outcome measures in the focus on walking condition (gait-priority condition), and N referred to

the outcome measures in the equally focus between gait and secondary tasks condition (no-priority condition). The cognitive-priority cost was calculated as (S-N)/N, where S referred to the outcome measures in the focus on secondary task condition (cognitive-priority condition). If the priority cost is 0, it indicates that the participants can not allocate attention between the priority condition and no-priority condition (39).

To examine the ability to allocate attention, each participant was instructed to walk at their preferred pace for 8 meters under dual-task condition (i.e. narrow walking while performing the counting backward by 2s task). For the narrow walking task, participants were asked to walk between two strips of tape, normalized to each participant as 50% of their ASIS width. For the counting backward by 2s task, each participant was instructed to count backward by 2s form any randomly two digits number. Three different instructions were given: 1) focus on both tasks equally (no priority); 2) focus on narrow walking task (gait priority); and 3) focus on the cognitive task (cognitive priority). The second and third conditions were randomly assigned to participants. For the "gait priority" condition, the participants were asked to focus mainly on the narrow walking task by trying not to step onto or outside each strip of tape. For the "cognitive priority" condition, they were asked to focus mainly on the counting backward task by counting the numbers as fast and as accurate as they can. Finally, for the "no priority" condition, each participant was asked to pay the same amount of attention on the gait task and cognitive task. Three trials of each condition were performed. Before performing the test, two practice trials were given to allow participants to become familiar with the tasks. The rate of missteps (i.e. the number of steps onto or outside either strip of tape within a certain period of time), the rate of

verbal responses (i.e. the number of responses within a certain period of time), and the rate of correct responses (i.e. the number of correct responses within a certain period of time) were recorded and used as a feedback to verify whether the participants could truly allocate their attention as instructed.

3.2.4 Balance: The balance performance was evaluated using the Berg Balance Scale (BBS) (Appendix D). The BBS is a test that developed to measure balance among older population. The Berg Balance Scale consists of 14 tasks that commonly use in everyday life (e.g. sit to stand, pick an object, turn, and stand on one leg) (20). Each task is scored on a scale of 0-4. Thus, total score ranges from 0 to 56, with higher scores indicates better balance performance. It has been suggested that the BBS is a good valid and reliability instrument used for evaluation of the effectiveness of interventions and for quantitative descriptions of function in clinical practice and research (40).

3.2.5 Gait speed: Timed 10-Meter Walk Test (Appendix E) is a reliable tool, which can be used to assess patient's mobility (41). The participants were instructed to walk 10 meters at their comfortable speed for 2 trials. Only the middle 6 meters were used to examine the gait speed to eliminate the effects of acceleration and deceleration (Figure 7). The mean of the two trials was used for further analyses.

Figure 7 The setting of Timed 10-meter walk test

3.2.6 Balance Confidence: Activities-Specific Balance Confidence Scale (ABC) (Appendix F) was used to assess balance confidence in daily activities. It has established reliability (42). Participants were asked to complete the 16-item questionnaire, providing a rating of balance confidence during performance of everyday and functional activities (e.g. walking around the house, walking up or down stairs, and bending over and pick up a slipper from the floor) (43). Each item is rated from 0% (no confidence) to 100% (complete confidence).

3.2.7 Depression: A Geriatric Depression Scale (GDS) is a reliable and valid self-rating depression screening scale for elderly populations (44, 45). Thai Geriatric Depression Scale (TGDS) (Appendix G) is developed as a screening measure for depressive symptom in Thai older adults. The TGDS consists of 30 items. A score of ≥ 13 suggests depression (46).

3.2.8 The dual-task decrements in gait: The dual-task decrement in gait was calculated form the difference of gait parameters between the single-task condition (i.e. walking) and the dual-task condition (i.e. walking while counting backward by 3s from any randomly two digits number).

3.3 Procedures

Participants completed a health questionnaire providing information on age, residential and marital status, medical history, current co-existing medical conditions, self-reported history of falls, type of assistive device used for ambulation, and list of prescription medications. They were also asked to perform cognitive function tests (i.e. the Attention Network Test and the ability to allocate attention), balance and mobility (i.e. the Berg Balance Scale and the Timed 10-Meter Walk Test), and the affect and emotional well-being tests (i.e. Thai-Geriatric Depression Scale and the Activities-Specific Balance Confidence Scale). Then, the participants were instructed to perform the serial 3 subtraction tasks when seated. The participants were asked to walk on the GAITRite electronic walkway for 8 meters with their self-selected walking speed under two conditions: walking without any secondary tasks (single-task condition), and walking while performing the counting backward by 3s from any randomly two digits numbers (dual-task condition). The single- and dual-task conditions were randomly assigned to participants. Five trials of each condition were performed. Gait parameters were measured using the GAITRite system automates. The gait variability was determined by using the coefficient of variation. For example, swing time variability = (standard deviation of swing time/mean)*100. Prior to data collection, a practice trial was given to allow participants to become familiar with the procedure. Enough rest was also provided between each trial and between tests.

3.4 Sample Size

To estimate the number of participants to be recruited into the study, the sample size was calculated using G*Power (47) based on Hausdorff's study (18). The

estimated sample size was 65. With 10% attrition rate, 75 older adults were recruited into this study.

3.5 Equipments

1. Personal data collection form

2. GAITRite system automates (CIR system, USA)

3. The Digital camera (Pentax Optio T10)

4. Stopwatch (JS-307)

5. Measurement tape

6. Stool (a height of 16 centimeters)

7. Standard chair (a height of 45 centimeters)

8. Masking tape

3.6 Statistical Analysis

The SPSS version 17.0 was used in this study. Descriptive statistics was used to describe the demographic features in the study participants. A paired t-test and a 1-way repeated measure analysis of variance with Bonferroni correction was used to determine the effect of the concurrent cognitive task and the effect of task prioritization on gait, respectively. The subsequent analysis was then undertaken in two stages.

Stage 1: Bivariate correlation analyses was used to determine the correlations between the independent variables (i.e. the Attention Network Test, the ability to allocate attention, Berg Balance Scale, Timed 10-Meter Walk Test, Activities-Specific Balance Confidence Scale, and Thai Geriatric Depression Scale) and the

dependent variables (i.e. dual-task decrement in gait parameters). The significant level was set at $p < 0.05$.

Stage 2: Multiple linear regression model (stepwise) was used to estimate the effects of the independent variables on each dependent variable (i.e. dual-task decrement in gait parameters). In each analysis, demographic variables (i.e. age, and drug taken per day ($<$ or $\geq$ 4)) were first entered into the model to control for any possible confounding effects. Then, related independent variables ($p < 0.25$ from a bivariate correlation analyses) were entered into the analysis (48). The alpha was set at 0.05.

3.7 Location

This study was conducted in the Laboratory room at the Department of the Physical Therapy, Faculty of Associated Medical Sciences, Chiang Mai University.