

## CHAPTER 3

### METHODS

This study comprised two parts: 1) a survey study on footwear styles, commonly worn by elderly women and 2) a comparison study on postural control ability of elderly women while wearing different footwear styles.

#### 1. A survey study on footwear styles commonly worn by elderly women

##### 1.1 Participants

One hundred and seventy Thai elderly women aged over 60 years were recruited from the area outside municipal limits. This sample size (at 99% confidence, and 10% estimate) was calculated from a formula below:

$$\begin{aligned} \text{A formula} \quad n &= \frac{NZ^2P(1-P)}{NE^2 + Z^2P(1-P)} \\ &= \frac{(83,123)(2.58)^2(0.25)}{(83,123)(0.1)^2 + (2.58)^2(0.25)} \\ &= 166.07 \text{ (170 persons)} \end{aligned}$$

where:  $n$  = Sample size,  $N$  = Population,  $Z$  =  $Z$  value (i.e. = 2.58 for 99% confidence level),  $P(1-P)$  = variance in population (maximum at 0.25), and  $E$  = Estimate

### ***Sampling Detail***

Data from National Statistical Office of Chiang Mai reported that in 2007, Chiang Mai consisted of 206,235 elderly populations which divided into 96,080 elderly men and 110,155 elderly women. Inside municipal limits consisted of 48,842 elderly populations (21,810 elderly men and 27,032 elderly women). Outside municipal limits consisted of 157,393 elderly populations (74,270 elderly men and 83,123 elderly women) (72).

The inclusion and exclusion criteria for the participants were as followed:

### ***Inclusion criteria***

1. Aged over 60 years
2. Female gender
3. Willingness to participate

### ***Exclusion criteria***

1. Communication impairment

## **1.2 Equipments**

1. Questionnaire about the common footwear styles worn by elderly women

## 2. A picture chart displaying footwear styles

### 1.3 Procedures

After given a verbal consent, participants were asked about their age, history of fall(s), cause(s) as well as injury-related to falls in the past 12 months. A chart with pictures of different footwear styles (Figure 5) were displayed to the participants. They were asked to identify the footwear style they worn most often in their daily living. Participants were asked to describe the specific footwear style they commonly worn if it is not presented in the picture chart.



Figure 5 A chart displaying 10 groups of footwear styles

Descriptive statistic was used to rank the footwear styles in order from the highest to lowest frequency rated by the participants.

## **2. A comparison study on postural control ability of elderly women while wearing different footwear styles**

### **2.1 Participants**

Thirty healthy elderly women aged 60-69 years who reside in Chiang Mai were recruited to participate in the study. The inclusion and exclusion criteria were as followed:

#### ***Inclusion criteria***

1. Aged 60-69 years
2. Female gender
3. Independence in walking and all ADL
4. Comprehend instructions and willing to participate in the study
5. Experienced wearing all types of footwear used in the study

#### ***Exclusion criteria***

1. Severe musculoskeletal problems/conditions (e.g. severe bowleg, osteoarthritis, active inflammatory joint diseases, pain level; VAS >3/10)
2. Neurological disorders (e.g. stroke, Parkinson's disease, epilepsy, dementia)

3. Severe cardiopulmonary conditions (e.g. asthma, Chronic Obstructive Pulmonary Disease)
4. Peripheral (foot) neuropathy
5. Uncorrected visual impairment
6. Impaired cognitive status based on cut off point of the Mini-Mental State Examination, Thai version 2002 (MMSE-Thai 2002)
7. Taking more than four medications or psychoactive medication(s)
8. Taking alcohol 6 hr before testing
9. Exercise regularly (at least 3 times/week)

## **2.2 Equipments**

1. Personal data collection form
2. Reach test setting (measurement tape, yard stick, marking tape)
3. mCTSIB setting (e.g. medium density foam surface, stop watch)
4. Timed Up and Go setting (e.g. firm chair, marking tape, stop watch)
5. Shoes (4 styles) with sizes ranging from 36-40

### 2.3 Independent and dependent variables

#### *Independent variables*

Independent variables were the top three footwear styles rated in the survey study and the athletic shoes (gold standard).

*Dependent variables were averaged score for the following postural control tests:*

1. One Leg Stance test (OLST)
2. Reach test (functional and lateral reach tests)
3. Modified Clinical Test of Sensory Interaction and balance (mCTSIB)
4. Gait speed (10-Meters Walk test; TMW)
5. Timed Up & Go (TUG) test

### 2.4 Procedures

Participants who are eligible to participate in the study were informed about the study purposes and testing protocol before signing an informed consent. Participants' demographic information including height, weight, medical conditions and history of falls in the previous 12 months were recorded. Proper footwear size was provided for each participant. The participants' postural control ability as assessed by the OLST, Reach test, mCTSIB, TMW, and TUG test were examined while they wore each footwear style. The order of the postural control tests as well as the footwear styles were randomized across all participants. For each test, a practice trial and sufficient

resting was allowed. An assistant was near by the participants throughout the testing to ensure safety.

***One-Leg Stance test (OLS):*** Participants were instructed to stand with weight evenly distributed between both feet, look straight ahead, and place hands on their hip. Participants were then instructed to lift one leg up and stand on the other leg for as long as possible (the lifted leg not to touch the stance leg). The tester recorded the time that participants can maintain in this posture, up to a maximum of 30 sec. Timing was stopped when participants move their hands off the hip or put a foot down. For each leg, 2 trials were performed and averaged.

***Reach Test:*** A measurement tape was fixed to the wall at the participant's shoulder level. For functional reach test (FRT), participants were instructed to stand perpendicular to the wall, with feet apart, make a fist, and raise the arm up (flex shoulder at 90 degree). The examiner recorded the initial distance using the landmark at the knuckle of the 3<sup>rd</sup> metacarpal. Participants were instructed to reach forward as far as possible without moving the feet or body touching the wall. The examiner recorded the farthest distance the participants can reach. The initial reading was subtracted from the final distance to obtain the functional reach score. For the lateral reach test, participants were instructed to stand with their back parallel to the wall. They were instructed to abduct their shoulder, and then reach to the side as far as possible without moving their feet or body touching the wall. All other procedures were similar to those performed for the functional reach test. Three trials were performed for each test and the averaged score was used in data analysis.

***Modified Clinical Test of Sensory Interaction and balance (mCTSIB):***

Participants were instructed to stand with their arms across their chest and their feet together in each of the 4 testing conditions: 1) stand on a firm surface with eyes open, 2) stand on a firm surface with eyes closed, 3) stand on a foam surface with eyes open, and 4) stand on a foam surface with eyes closed. The tester recorded the time that participants can maintain in each condition, up to a maximum of 30 sec. Three trials were performed and the recorded times were averaged for each condition. Criteria to stop timing were when the participants move their hands off their chest, move their feet from the starting position, fall, or if they open their eyes during an eyes-closed trial (63, 64).

***Gait speed (10-Meter walk test; TMW):*** Participants were instructed to walk on a marked 10-m walkway at a “comfortable (natural) speed”. Gait speed was measured in a second with a stopwatch. Recording times for the two trials were averaged and used in data analysis (65, 73).

***Timed Up & Go test (TUG):*** A 3-m distance was marked on the floor in front of a firm arm-chair (seat height of 45 cm). The test began with each participant sat with back against the chair, arms resting on the lap, and feet just behind the distance-marker on the floor. Participants were instructed to stand up, walk as quickly as possible to the 3-m, turn around, come back, and sit on the chair. Timing (measured in seconds) was recorded on the command “go” and ceased when participants return to a seated position with participant’s back touched the backrest of the chair. A practice trial was allowed and then followed by 3 recorded trials. Data obtained during the 3 recorded trials were averaged and used for analysis (65, 70).



### **3. Statistical analysis**

All data were inspected for normal distribution. For the first part (survey study), descriptive statistics were used to rank the footwear styles in order from the highest to lowest frequency rated by the participants.

In the second part of the study, one-way repeated measure analysis of variance (ANOVA) was used to identify differences of the postural control ability (as measured by OLST, Reach test, mCTSIB, TMW, and TUG) among the four footwear conditions. Post hoc analysis (multiple comparison tests, Bonferroni) was conducted to identify the location of the differences. A level of significance was set at  $p < .05$ .

### **4. Data collection location**

The survey study was conducted in the area outside municipal limits in Chiang Mai area. The second part of the study was conducted at the Department of Physical Therapy, Faculty of Associated Medical Sciences, Chiang Mai University.