

CHAPTER 4

RESULTS

Part I. A survey study on footwear styles commonly worn by elderly women

One hundred and seventy Thai elderly women recruited from the area outside municipal limits participated in the first part of the study. Their mean age was 68.49 ± 5.39 yrs and ranged between 60 to 80 yrs. Information of fall in the past 12 months of participants are shown in Table 1. Approximately 25.3% of participants had fallen in the previous year. Approximately 53.5% of them had at least one fall in the past 12 months. Falls occurred outdoors (53.5%) more often than indoor (41.9%). Sixty percent of the participants reported fall-related injuries such as fractures, musculoskeletal pain, lacerations, and head injury. Slip was the most common cause of fall (53.5%), followed by trip (30.2%) and other causes (14%). Of those elderly fallers, 69.8% reported falls with footwear on.

Table 1 Fall history in the past 12 months of participants

Conditions	Number (n)	Percent (%)
Fall history in past 12 mo. (N=170)		
- no	127	74.7
- yes	43	25.3
Frequency of fall (N=43)		
- one fall	23	53.5
- more than once a year	15	34.9
- do not remember/ not sure	5	11.6
Locations of fall (N=43)		
- outdoor	23	53.5
- indoor	18	41.9
- both locations	2	4.7
Situation of fall (N=43)		
- on footwear	30	69.8
- off footwear	12	27.9
- do not remember/ not sure	1	2.3
Fall-related injuries (N=43)		
- yes	26	60.5
- no	17	39.5
Causes of fall (N=43)		
- slip	23	53.5
- trip	13	30.2
- syncope	2	4.7

- loss of balance	1	2.3
- external forces (such as being pushed)	1	2.3
- others	2	4.7

Findings revealed that the most common footwear worn by Thai elderly women living outside municipal limits was sandal (45.3%), followed by thong (28.8%), and high-heel shoes (12.4%). The footwear styles worn most often in daily living for Thai elderly women are shown in Table 2.

Table 2 Percentage of the footwear styles rated by participants as the most often worn footwear in daily living (N=170)

Footwear styles	Number (n)	Percent (%)
Sandal		
	77	45.3
Thong (flip-flops)		
	49	28.8
		
High-heel shoes		
	21	12.4

Canvas shoes


7

4.1

Court shoes

6

3.5

Sandal with fasten heel

4

2.4

Mule shoes

4

2.4

Other (i.e. surgical shoes)

2

1.2

Athletics shoes

0

0

Part II. A comparison study on postural control ability of elderly women while wearing different footwear styles

A total of 30 healthy elderly women participated in the second part of the study. They read and signed an informed consent approved by the Ethical Research Committee of the Faculty of Associated Medical Sciences, Chiang Mai University. Participants were interviewed about the demographic information including height, weight, medical conditions, history of falls in the past 12 months, and cognitive status. Their mean age was 63.23 ± 3.22 yrs, mean height was 1.51 ± 0.05 m, mean weight was 55.74 ± 9.00 kg, and mean Body Mass Index (BMI) was 24.47 ± 4.11 . The characteristics of the participants are shown in Table 3. The 4 footwear styles used in the comparison study are shown in Table 4.

Table 3 Characteristics of the participants (N=30)

Characteristics	Mean \pm SD	Range (minimum-maximum)
Age (years)	63.23 ± 3.22	60 - 69
Height (m)	1.51 ± 0.05	1.40 - 1.61
Weight (kg)	55.74 ± 9.00	39 - 78
BMI	24.47 ± 4.11	16.23 - 34.67

SD = Standard deviation

Table 4 Features of each footwear style for the comparison study (size 38)

Footwear styles	Sandal	Thong	High-heel	Athletic
Features				
Weight (g.) (one side)	164.31	155.01	165.95	350.00
Sole width (cm.)	8.3	9.7	8.0	10.5
Heel height (cm.)	1.7	1.4	3.7	2.5
Bevelled heel (degree)	10.0	0.0	0.0	40.0
Heel collar	No	No	No	Yes
Sole hardness	relatively hard	relatively soft	relatively hard	relatively hard
Sole pattern				

The participants completed all postural control tests. The mean and standard deviation (SD) of postural control variables for the 4 footwear conditions are shown in Table 5. All participants received the maximum score (30 seconds) of the modified Clinical Test of Sensory Interaction and Balance (CTSIB) on the firm surface with eye open condition. One-way repeated measure analysis of variance (ANOVA) revealed no significant differences of all dependent variables among the 4 footwear conditions except the modified CTSIB on the foam surface with eye closed condition and Timed Up and Go (TUG).

Table 5 Comparisons between 4 footwear conditions for postural control test

(Mean±SD)

Variables	Sandal	Thong	High-heel	Athletics	<i>p</i> - values
OLST (s)	20.97±9.16	21.06±8.32	20.38±8.76	20.91±8.33	.90
Reach test (cm)					
• Functional	27.43±6.48	27.57±6.06	26.54±6.13	26.72±6.36	.47
• Lateral	21.05±6.46	22.65±5.52	20.76±5.92	20.29±5.53	.11
mCTSIB (s)					
• <i>Firm surface</i>					
- Eyes open	30	30	30	30	-
- Eyes closed	29.59±1.68	29.57±1.75	29.20±2.47	29.96±0.24	.43
• <i>Foam surface</i>					
- Eyes open	30	30	29.98±0.09	30	.39
- Eyes closed	12.04±10.20	17.39±11.47	12.63±10.27	16.89±10.25	.001*
TMW (m/s)	1.19±0.15	1.19±0.13	1.16±0.14	1.20±0.15	.12
TUG (s)	8.83±1.03	8.82±1.04	9.02±1.33	8.69±1.23	.04*

* Significant difference at $p < .05$

Abbreviations: OLST = One Leg Stance Test; mCTSIB = modified Clinical Test of Sensory Interaction and Balance; TMW = 10-meter Walk test; TUG = Timed Up and Go

One Leg Stance Test (OLST)

The mean OLST scores for each footwear condition are shown in Figure 6. Findings revealed that the participants were able to stand on one leg for the longest duration while wearing thong (21.06±8.32) followed by sandal (20.97±9.16), athletics shoes (20.91±8.33) and high-heel shoes (20.38±8.76) seconds, respectively. Statistical analysis showed no significant differences among the four footwear conditions ($p = .90$).

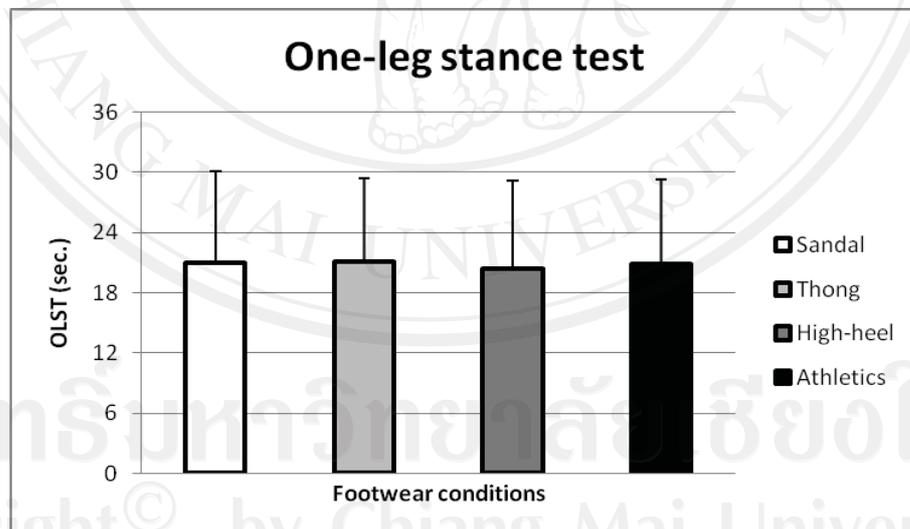


Figure 6 Time on OLST for each footwear condition

Reach Test

The mean functional reach test scores while wearing thong (27.57 ± 6.06 cm) was better than that while wearing sandal (27.43 ± 6.48 cm), athletics shoes (26.72 ± 6.36 cm), and high-heel shoes (26.54 ± 6.13 cm), respectively (Figure 7). The mean scores of lateral reach test for the four footwear conditions are shown in Figure 8. Participants reached to the side farther while wearing thong (22.65 ± 5.52 cm) compared to while wearing sandal (21.05 ± 6.46 cm), high-heel shoes (20.76 ± 5.92 cm), and athletics shoes (20.29 ± 5.53 cm), respectively. However, statistical analyses found no significant differences among the four footwear conditions for both functional reach ($p = .47$) and lateral reach tests ($p = .11$).

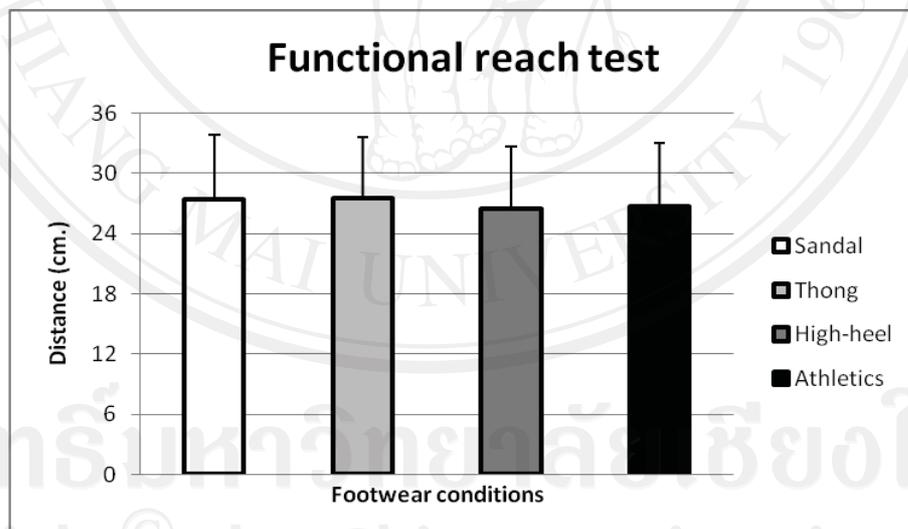


Figure 7 Comparison between each footwear condition for function reach test

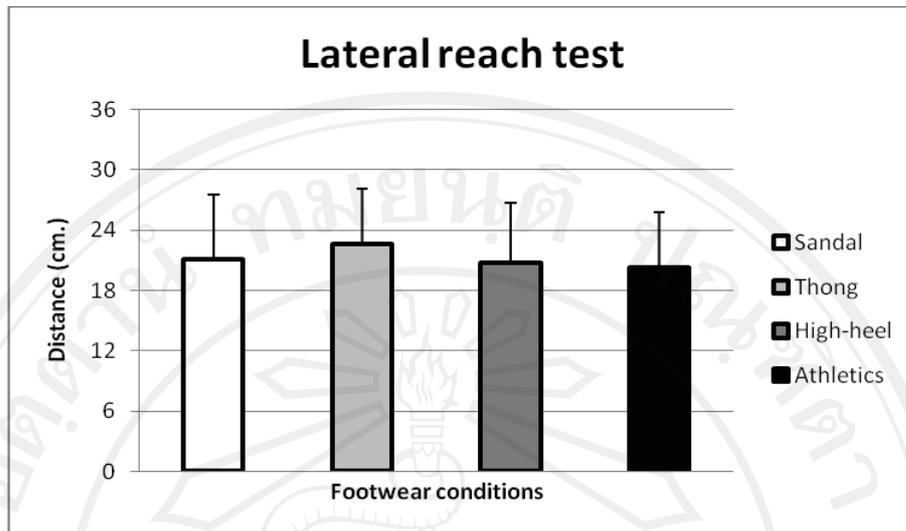


Figure 8 Comparison between each footwear condition for lateral reach test

Modified Clinical Test of Sensory Interaction and Balance (CTSIB)

All participants received maximum score (30 seconds) of the modified CTSIB on the firm surface with eyes open condition. The mean modified CTSIB score on firm surface with eyes closed was 29.59 ± 1.68 for sandal, 29.57 ± 1.75 for thong, 29.20 ± 2.47 for high-heel shoes, and 29.96 ± 0.24 for athletic shoes (Figure 9). The modified CTSIB scores on firm surface with eyes closed were not significant differences ($p = .43$) among the four footwear conditions.

The mean modified CTSIB scores on foam surface with eyes open condition are shown in Figure 10. All participants received maximum scores (30 seconds) for all footwear conditions except for the high-heel shoes condition (29.98 ± 0.09). There were no significant differences for the modified CTSIB scores on foam surface with eyes open ($p = .39$). The mean modified CTSIB scores on foam surface with eyes closed condition while wearing sandal, thong, high-heel shoes, and athletics shoes

were 12.04 ± 10.20 , 17.39 ± 11.47 , 12.63 ± 10.27 , and 16.89 ± 10.25 , respectively (Figure 11). One-way repeated measure ANOVA indicated significant differences in modified CTSIB scores among the four footwear conditions ($p = .001$). Bonferroni revealed that for the foam surface with eyes closed condition, the participants received significant higher score when they wore athletic shoes as compared to sandal ($p = .02$) and approaching significant higher score as compared to high-heel ($p = .05$).

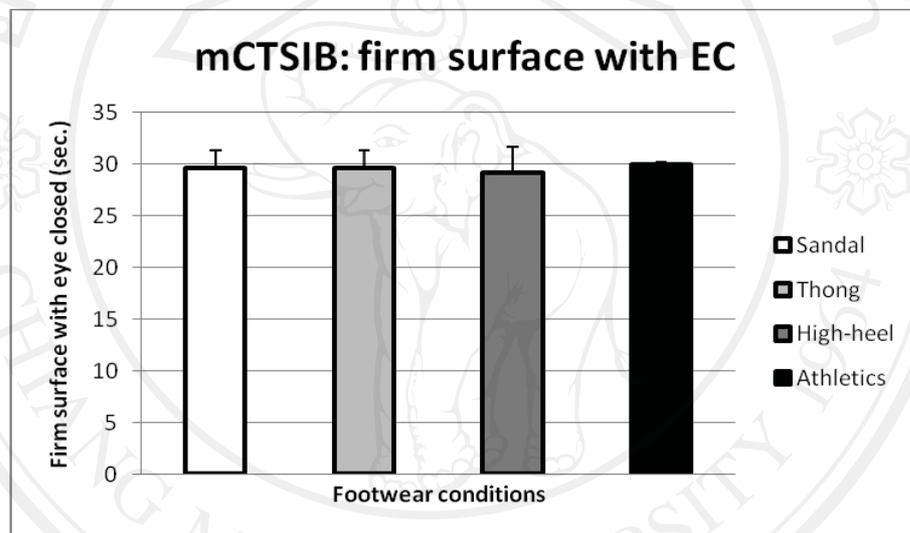


Figure 9 Comparison between each footwear condition for modified CTSIB scores on firm surface with eyes closed

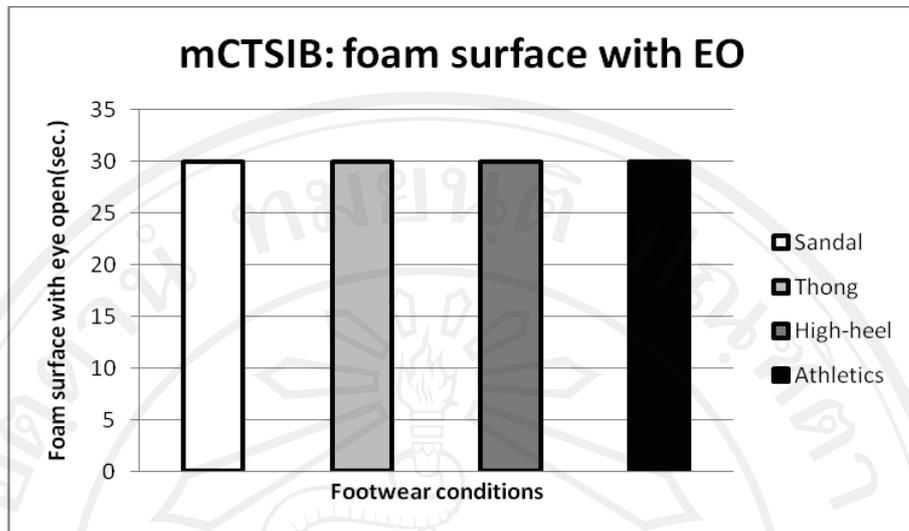


Figure 10 Comparison between each footwear condition for modified CTSIB scores on foam surface with eyes open

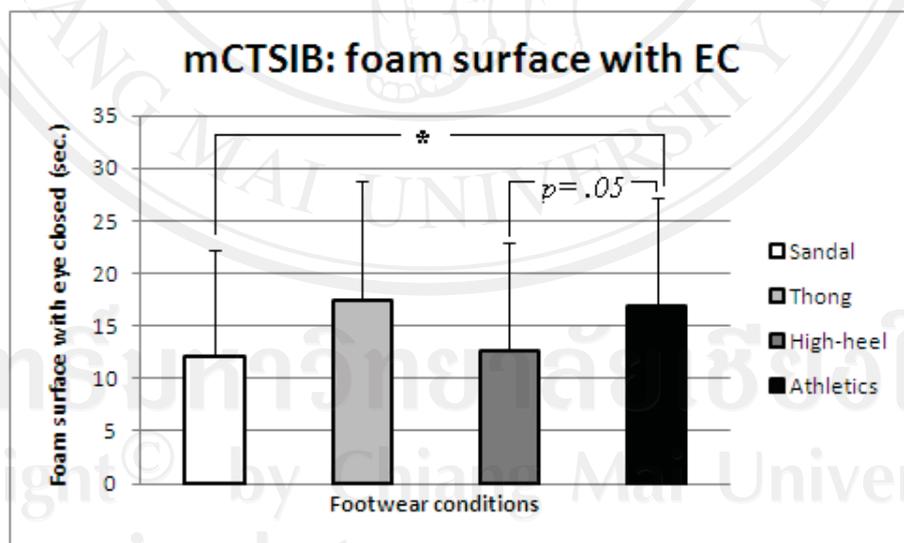


Figure 11 Comparison between each footwear condition for modified CTSIB scores on foam surface with eyes closed

* Bonferroni showed significant difference at $p < .05$

Gait speed (10 Meter Walk Test; TMW test)

The average gait velocity of the TMW test for each footwear condition is shown in Figure 12. The mean gait velocity of the TMW test while wearing sandal, thong, high-heel, and athletics shoes were 1.19 ± 0.15 , 1.19 ± 0.13 , 1.16 ± 0.14 , and 1.20 ± 0.15 m/s, respectively. Statistical analyses found no significant differences among the four footwear conditions for TMW test ($p = .15$).

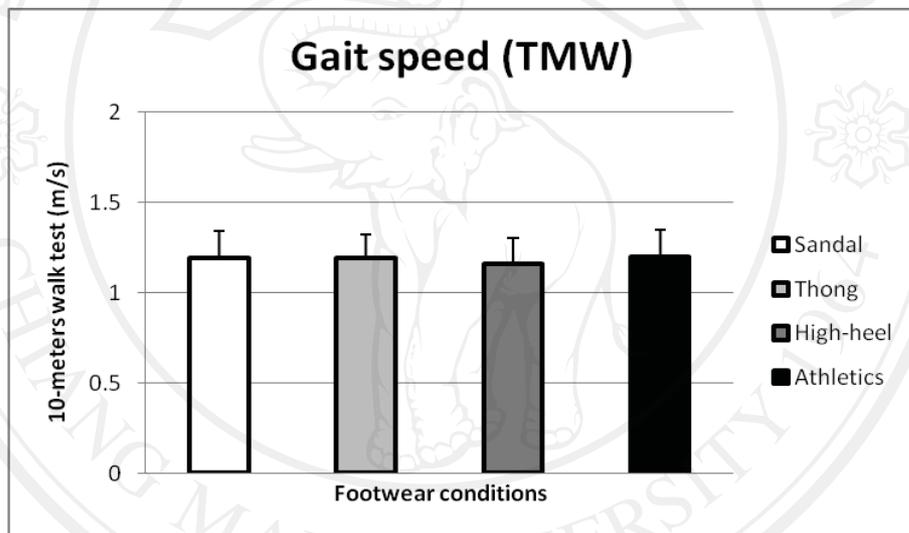


Figure 12 Comparison between each footwear condition for Gait speed

Timed Up and Go Test (TUG)

The mean TUG scores of each footwear condition are shown in Figure 13. The mean TUG scores when participants wore athletic shoes, sandal, thong, and high-heel shoes were 8.69 ± 1.23 , 8.83 ± 1.03 , 8.82 ± 1.04 , and 9.02 ± 1.33 , respectively. One-way repeated measure ANOVA revealed significant differences for the time taken to complete TUG test among the 4 footwear conditions ($p = .04$). Bonferroni revealed that the participants performed faster on the TUG when they wore athletic shoes compared to high-heel shoes ($p = .04$).

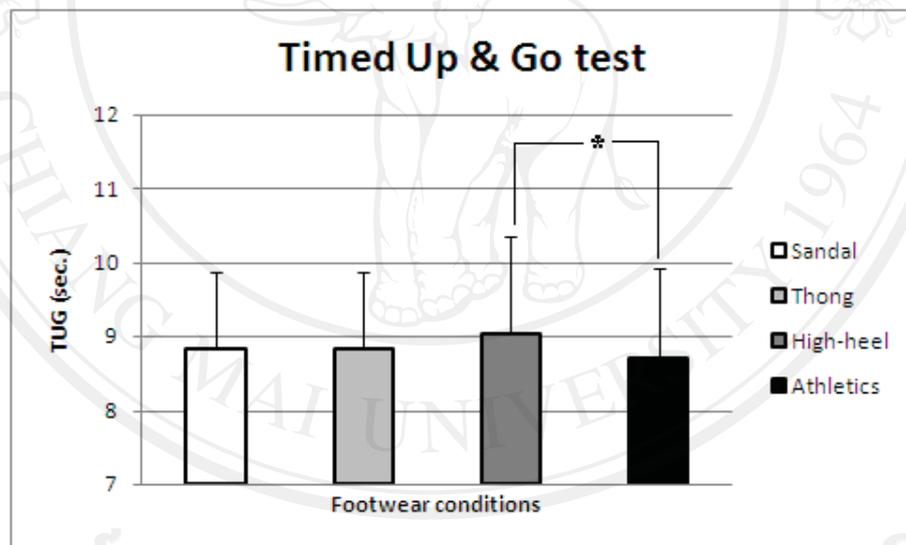


Figure 13 Comparison between each footwear condition for Timed Up and GO (TUG) scores

* Bonferroni showed significant difference at $p < .05$