CHAPTER IV

RESULT

A cross-sectional study was conducted to determine the association between particular factors and the presence of foot pain during the past month in pre-retirement aged personnel of Chulalongkorn University. Data analysis began with descriptive statistic for demographic data and inferential statistic for the comparison of each factor between the participants with foot pain and without foot pain. Data collection was done during Febuary and March 2013. A total of 250 participants from 18 organizations agreed to attend the study. Using a screening questionnaire, 29 participants were excluded. Therefore, the remaining subjects were 221 participants in total. The characteristics of participants are shown in Table 1.

4.1. Demographic data of participants

As seen in Table 1, almost all of the participants were female (84.6%) with the average age of 53.2 ± 4.3 (mean ± standard deviation). The mean of body mass index was 24.8 ± 4.3 kg/m^2 which were grouped into the normal weight group (the cut-off value for overweight group = 25.0 kg/m^2) (WHO, 2004). The mean of waist hip ratio was 0.87 ± 0.1 which were grouped into the abdominal obesity group and related with cardiovascular disease (the cut-off value for abdominal obesity = 0.85 for female and 0.90 for male) (WHO, 2008). However, almost all of the participants were healthy group (86.4%). 43.3% of the participants with medical conditions were hypertension and 33.3% were hyperlipemia. Considering in education level, the most participants graduated higher bachelor degree (41.8%). Almost all of the participants were supporting staff (73.3%) with the mean working experience of 305.9 ± 88.6 months or more than 20 years and the mean working duration of 47.2 ± 9.8 hours per week. A hundred five participants (47.5%) were defined as foot pain group in this study.

Table 1 Characteristics of Chulalongkorn University personnel (n=221)

Characteristics	**n**	**%**	**Mean**	**SD**
Gender				
- Male	34	15.4		
- Female	187	84.6		
Age (Years)			53.2	4.3
Body mass index (kg/m2) (min-max: 17.1-42.5)			24.8	4.3
- Male (min-max: 19.0-33.7)			25.1	3.8
- Female (min-max: 17.1-42.5)			24.7	4.4
Waist hip ratio (min:max: 0.70-1.04)			0.87	0.1
- Male (min-max: 0.81-1.04)			0.91	0.1
- Female (min-max: 0.70-1.02)			0.86	0.1
Education Level				
- Lower than Bacheolar degree	42	19.1		
- Bacheolar degree	86	39.1		
- Higher than bacheolar degree	92	41.8		
Job categories				
- Academic Staff	59	26.7		
- Supporting Staff	162	73.3		
Working Experience (months) (min-max: 20-420)			305.9	88.6
Working duration (hours per week) (min-max: 26-84)			47.2	9.8
Participants with medical history	30	13.6		
Participants with foot pain	105	47.5		
- Male	17	50.0		
- Female	88	47.1		

4.2. The comparison in health-related quality of life between two groups

Data on 217 participants were used to analyze the differences between participants with foot pain and participants without foot pain in two dimensions of health-related quality of life which were composed of physical component summary (SF-12 PCS) and mental component summary (SF-12 MCS). 4 participants were excluded from the analysis because of some uncompleted data. As seen in Table 2, the mean of SF-12 PCS ± SD was 44.5 ± 7.9 for the total participants, 42.5 ± 7.9 for the participants with foot pain, and 46.3 ± 7.5 for the participants without foot pain. The mean of SF-12 MCS ± SD was 48.4 ± 7.3 for the total participants, 46.6 ± 7.8 for the participants with foot pain, and 49.9 ± 6.4 for the participants without foot pain. There were significant differences of SF-12 PCS ($p < 0.001$) and SF-12 MCS ($p = 0.001$) between participants with foot pain and without foot pain using Independent t-test at significant level $p \leq 0.05$.

Table 1 Health-related quality of life of Chulalongkorn personnel (n=217)

SF-12	Mean (SD)		Total
	With foot pain (n=105)	**Without foot pain (n=112)**	**(n=217)**
Health-related quality of life			
SF-12 PCS	42.5 (7.9)*	46.3 (7.5)*	44.5 (7.9)
SF-12 MCS	46.6 (7.8)**	49.9 (6.4)**	48.4 (7.3)

* p-value < 0.001 using Independent t-test at significant level $p \leq 0.05$

** p-value = 0.001 using Independent t-test at significant level $p \leq 0.05$

4.3. The association between particular factors and foot pain

The prevalence of foot pain during the past month was 47.5% from Table 1. Then, univariate analysis was used to compare the related factors between the participants with foot pain (n=105) and the participants without foot pain (n=116). The comparisons of related factors between groups are presented in Table 3 for categorical data and Table 4 for continuous data.

According to the Table 3, the participants with foot pain were found higher in male (50.0%) than female (47.1%). The married participants reported their foot pain (50.8%) more than divorced (45.5%) and single (42.3%) participants, respectively. By education level, the participants with foot pain had higher percentage in lower bachelor degree (50.0%) than bachelor degree (48.8%) and higher bachelor degree (44.6%), respectively. The participants with foot pain were more likely to reported low back pain history (58.2%), hip/thigh pain history (59.5%), knee pain history (62.6%), and falling history (63.0%) than the participants without foot pain.

Regarding work-related physical factors, the supporting staff reported their foot pain (49.4%) more than academic staff (42.4%). The participants with foot pain were more likely to have working posture in prolong standing (56.4%), walking for long distance (50.5%), and lifting (60.0%) than the participants without foot pain. By working environment, the participants without foot pain reported appropriate working environment regarding without noise disturbing (54.9%), appropriate temperature (50.6%), enough lighting (52.9%), and good air ventilation (53.7%) more than the participants without foot pain. The rest break in every 2 hours was also found higher in the participants without foot pain (51.1%) than the participants with foot pain (48.9%).

In addition, the participants without foot pain had physical activity in both of weight bearing exercise (54.0%) and non weight bearing exercise (53.8%) more than the participants with foot pain. Smoking history was found in the foot pain group (70.0%) more than the non foot pain group (30.0%). The participants with foot pain were more likely to concern about their foot care of general self-foot assessment (51.6%), foot soaking (55.0%), nail cut straight (50.7%), and foot

massage (55.8%) than the participants without foot pain. However, the result showed opposite way in the shoewear decision; the participants without foot pain were inclined to use the suitable footwear regarding appropriate foot size (52.5%), soft insole (55.3%), heel counter softness (57.9), adjustable fixation (53.8%), sole flexion point (50.9%), and heel height within 2.5 cm (55.5%) more than the participants without foot pain.

Considering foot problem assessment, the participants with foot pain were more likely to have callus formation at hindfoot/heel (72.7%) and lesser toes deformities (70%) than the participants without foot pain. However, the foot pain group had less callus formation at big toe (38.9%), 2^{nd}-5^{th} toes (43.2%), fore foot (47.3%), and hallux valgus deformity (62.1%) than the non foot pain group. By the foot types, the partcipants with foot pain had pronated foot type (57.8%), supinated foot type (58.6%), and flat arch (66.7%) more than the participants without foot pain. The normal strength of ankle plantarflexors, ankle dorsiflexors, and the equal leg length were found more in the non foot pain group (63.6%; 59.2%; and 52.8%, respectively) than the foot pain group, while the normal strength of foot instrinsic muscles were found more in the foot pain group (50.8%) than the non foot pain group.

As shown in Table 3, the analysis using chi-square test found 14 factors showing p-value < 0.100. The factors were composed of history of low back pain ($p < 0.001$), history of hip/thigh pain ($p = 0.005$), history of knee pain ($p < 0.001$), falling history ($p = 0.019$), prolong standing of more than 2 hours ($p = 0.091$), lifting of more than 5 kg ($p = 0.025$), callus formation at hindfoot/heel ($p = 0.013$), the presence of hallux valgus ($p = 0.042$), the presence of lesser toe deformities ($p = 0.035$), normal foot type ($p = 0.007$), pronated foot type ($p = 0.050$), flat arch ($p = 0.047$), ankle plantarflexor muscles strength ($p = 0.034$), and ankle dorsiflexor muscles strength ($p = 0.008$).

Table 2 The comparison of related factors (categorical data) between participants with foot pain and participants without foot pain using Chi-square test (n=221)

Related factors	n (%)		p-value
	With foot pain (n=105)	Without foot pain (n=116)	
Individual factors			
Gender			0.752
- Male	17 (50.0)	17 (50.0)	
- Female	88 (47.1)	99 (52.9)	
Marital status			0.503
- Single	30 (42.3)	41 (57.7)	
- Married	65 (50.8)	63 (49.2)	
- Divorced	10 (45.5)	12 (54.5)	
Education level			0.786
- Lower bachelor degree	21 (50.0)	21 (50.0)	
- Bachelor degree	42 (48.8)	44 (51.2)	
- Higher bachelor degree	41 (44.6)	51 (55.4)	
History of MSDs at these areas:			
- Low back pain	71 (58.2)	51 (41.8)	**<0.001***
- Hip/Thigh pain	44 (59.5)	30 (40.5)	**0.005***
- Knee pain	77 (62.6)	46 (37.4)	**<0.001***
Falling history	29 (63.0)	17 (37.0)	**0.019***
Work-related physical factors			
Job categories			0.356
- Academic Staff	25 (42.4)	34 (57.6)	
- Supporting Staff	80 (49.4)	82 (50.6)	
Prolong sitting more than 2 hours	80 (46.8)	91 (53.2)	0.998
Prolong standing more than 2 hours	31 (56.4)	24 (43.6)	**0.091***
Walking more than 2 km /day	47 (50.5)	46 (49.5)	0.277

Table 3 continued.....

Lifting more than 5 kg	33 (60.0)	22 (40.0)	**0.025***
Stair climbing at least 20 steps	68 (46.6)	78 (53.4)	0.989
Working environment:			
Without noise disturbing	65 (45.1)	79 (54.9)	0.335
Appropriate temperature	88 (49.4)	90 (50.6)	0.229
Enough lighting	98 (47.1)	110 (52.9)	0.631
Good air ventilation	69 (46.3)	80 (53.7)	0.610
Rest break in every 2 hours	87 (48.9)	91 (51.1)	0.565
Health behavior factors			
Leisure physical activity	55 (46.6)	63 (53.4)	0.832
Types of exercise			0.989
- Weight bearing	46 (46.0)	54 (54.0)	
- Non weight bearing	12 (46.2)	14 (53.8)	
History of smoking	11 (70.0)	5 (30.0)	0.256
General foot care:			
General self-foot assessment	33 (51.6)	31 (48.4)	0.414
Foot skin moisture	40 (41.7)	45 (52.9)	0.960
Foot soaking	11 (55.0)	9 (45.0)	0.454
Nail cut straight	74 (50.7)	72 (49.3)	0.217
Foot massage	24 (55.8)	19 (44.2)	0.223
Foot stocking	22 (38.6)	35 (61.4)	0.118
Foot exercise	22 (50.0)	22 (50.0)	0.709
General shoewear:			
Appropriate foot size	96 (47.5)	106 (52.5)	0.550
Soft insole	72 (44.7)	89 (55.3)	0.254
Heel counter softness	51 (42.1)	70 (57.9)	0.170
Adjustable fixation	30 (46.2)	35 (53.8)	0.866
Sole flexion point	57 (49.1)	59 (50.9)	0.459

Table 3 continued.....

Heel height			0.457
- 0-2.5 cm	57 (44.5)	71 (55.5)	
- 2.6-5.0 cm	37 (48.1)	40 (51.9)	
- More than 5.0 cm	7 (63.6)	4 (36.4)	
Physical examination			
Callus formation at these areas:			
Big toe	21 (38.9)	33 (61.1)	0.144
2^{nd} – 5^{th} toes	19 (43.2)	25 (56.8)	0.520
Fore foot	53 (47.3)	59 (52.7)	0.954
Hind foot/Heel	16 (72.7)	6 (27.3)	**0.013***
Degree of hallux valgus			**0.042***
- None	69 (54.8)	57 (45.2)	
- Mild	21 (36.2)	37 (63.8)	
- Moderate and severe	15 (40.5)	22 (59.5)	
Presence of lesser toes deformities	14 (70.0)	6 (30.0)	**0.035***
Foot posture index:			
Normal type	51 (39.8)	77 (60.2)	**0.007***
Pronated type	37 (57.8)	27 (42.2)	**0.050***
Supinated type	17 (58.6)	12 (41.4)	0.199
Staheli's arch index:			
Normal arch	71 (44.9)	87 (55.1)	0.225
Flat arch (Pes planus)	16 (66.7)	8 (33.3)	**0.047***
High arch (Pes cavus)	18 (46.2)	21 (53.8)	0.852
Muscle strength testing:			
PGT1			0.298
- Pass	96 (48.7)	101 (51.3)	
- Fail	9 (37.5)	15 (62.5)	

Table 3 continued.....

PGT2			0.281
- Pass	61 (50.8)	59 (49.2)	
- Fail	44 (43.6)	57 (56.4)	
Ankle plantarflexors			**0.034***
- Fair	18 (66.7)	9 (33.3)	
- Good	67 (48.2)	72 (51.8)	
- Normal	20 (36.4)	35 (63.6)	
Ankle dorsiflexors			**0.008***
- Good	47 (59.5)	32 (40.5)	
- Normal	58 (40.8)	84 (59.2)	
Leg length measurement			0.778
- Equal	91 (47.2)	102 (52.8)	
- Unequal	14 (50.0)	14 (50.0)	

* p-value < 0.100 using Chi-square test

According to the Table 4, the participants without foot pain had the average of sleeping duration (6.2 ± 1.0), working experience in months (310.6 ± 87.4), and working duration (50.9 ± 9.2) more than the participants with foot pain. While the participants with foot pain were more likely to spent time in sitting posture (299.4 ± 119.4) and standing posture (105.4 ± 67.9) than the participants without foot pain. Considering the obesity index, the foot pain group had the average of body mass index (25.4 ± 4.2) and waist hip ratio (0.874 ± 0.1) more than the non foot pain group.

As shown in Table 4, the analysis using independent t-test found only one factor showing p-value < 0.100 i.e. body mass index (p = 0.054).

Table 3 The comparison of related factors (continuous data) between participants with foot pain and participants without foot pain using Independent t-test (n=221)

Related factors	Mean (SD)		p-value
	With foot pain (n=105)	Without foot pain (n=116)	
Individual factors			
Sleeping duration (hours per day)	6.0 (1.1)	6.2 (1.0)	0.228
Work-related physical factors			
Working experience (months)	300.9 (90.0)	310.6 (87.4)	0.416
Time working per week (hours)	43.1 (7.7)	50.9 (9.2)	0.373
Time spent in these posture:			
Walking	115.9 (69.0)	115.9 (92.6)	0.997
Sitting	299.4 (119.4)	286.9 (119.0)	0.468
Standing	105.4 (67.9)	96.0 (73.3)	0.372
Physical examination			
Body mass index (kg/m2)	25.4 (4.2)	24.2 (4.3)	**0.054***
Waist per hip ratio	0.874 (0.1)	0.865 (0.1)	0.415

* p-value < 0.100 using Independent t-test

4.4. Factors associated with foot pain in pre-retirement aged

The factors with p-value < 0.100 from Table 3 and Table 4 were used for further analysis. The odds ratios of each factor with significant association were unadjusted odds ratio (crude OR); they might be related with each others. Therefore, the multiple logistics regression with backward stepwise method was used to finalize the model with adjusted odds ratio (adj. OR) and 95% confidence interval (95% CI). The last step of backward stepwise regression analysis as demonstrated in Table 5 showed the factors related with foot pain at significant level p-value ≤ 0.05 which were composed of low back pain history (p = 0.034), knee pain history (p = 0.001), prolong standing (p = 0.050), mild hallux valgus (p = 0.010), and fair ankle plantarflexors strength (p = 0.026).

According to the Table 5, the personnel with history of low back pain and knee pain were more likely to have foot pain (adj. OR = 2.04, 95% CI = 1.06-3.95; and adj. OR = 3.24, 95% CI = 1.67-6.31, respectively). Also, the prolong standing posture showed the elevated risk for foot pain (adj. OR = 2.12, 95% CI = 1.00-4.49). The physical examination found the significant associations of mild hallux valgus and fair ankle plantarflexors strength with foot pain (adj. OR = 0.37, 95% CI = 0.17-0.79; and adj. OR = 3.60, 95% CI = 1.17-11.10, respectively). Considering the pronated foot type, the result showed almost significant association with foot pain (adj. OR = 1.97, 95% CI = 1.00-3.92).

Table 4 The odds ratio (OR) and 95% confidence interval (CI) of factors associated with foot pain in the final model using Backward stepwise regression analysis

Related factors	Bivariate analysis		Multivariate analysis	
	Crude OR (95% CI)	p-value	Adj. OR (95% CI)	p-value
History of low back pain				
- No	1.00		1.00	
- Yes	3.02 (1.72-5.30)	**<0.001****	2.04 (1.06-3.95)	**0.034****
History of knee pain				
- No	1.00		1.00	
- Yes	4.28 (2.41-7.61)	**<0.001****	3.24 (1.67-6.31)	**0.001****
Falling history				
- No	1.00		1.00	
- Yes	2.20 (1.13-4.30)	**0.021****	2.04 (0.93-4.49)	0.077
Prolong standing				
- No	1.00		1.00	
- Yes	1.70 (0.92-3.15)	0.093	2.12 (0.998-4.49)	**0.050****
Hallux valgus				
- None	1.00		1.00	
- Mild	0.47 (0.25-0.89)	**0.020****	0.37 (0.17-0.79)	**0.010****
- Moderate	0.47 (0.21-1.04)	0.063	0.58 (0.23-1.47)	0.252
- Severe	2.48 (0.25-2.45)	0.437	0.97 (0.09-10.6)	0.979
Pronated foot type				
- No	1.00		1.00	
- Yes	1.79 (0.996-3.23)	**0.051**	1.97 (0.994-3.92)	**0.052**
Ankle plantarflexors strength				
- Normal	1.00		1.00	
- Good	1.63 (0.86-3.10)	0.137	1.84 (0.84-4.04)	0.130
- Fair	3.50 (1.33-9.24)	**0.011****	3.60 (1.17-11.1)	**0.026****

** Significant level at p-value ≤ 0.05