

QUALITY OF LIFE AND FACTORS ASSOCIATED WITH FOOT PAIN IN PRE-RETIREMENT AGED AT CHULALONGKORN UNIVERSITY, THAILAND

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ABSTRACT: Foot pain is commonly found among working population especially in older workers. The aims of this study were to determine the related factors of socio demographic, occupation, health behavior, and anthropometry to the prevalence of musculoskeletal foot pain during the past month in pre-retirement aged of Chulalongkorn University personnel, and to explore the association between foot pain and the overall quality of life. A cross-sectional study design was conducted on 221 subjects aged between 50 and 60 years at Chulalongkorn University by cluster sampling technique to recruit the sample at each sector. The main outcome variable was foot pain identified by the persons with current foot pain and pain during the last month for at least 1 score of the Manchester foot pain and disability index (MFPDI). A self-reported questionnaire and a set of physical examinations performed by a physiotherapist were used to collect data about the factors associated with foot pain and health-related quality of life. The study revealed that 47.5% of participants were defined as foot pain group. The positive significant differences of overall quality of life were found between the participants with foot pain and without foot pain (p -value < 0.001 for SF-12 PCS; p -value = 0.001 for SF-12 MCS). Using backward stepwise logistics regression, various significant factors related to foot pain were found including having previous history of low back pain (adjusted OR=2.04, 95%CI=1.06-3.95) or knee pain (adjusted OR=3.24, 95%CI=1.67-6.31), prolonged standing posture at work (adjusted OR=2.12, 95%CI=1.00-4.49), the presence of mild hallux valgus (adjusted OR=0.37, 95%CI=0.17-0.79), weakness of ankle plantar flexors strength (adjusted OR=3.60, 95%CI=1.17-11.1), and pronated foot type (adjusted OR=1.97, 95%CI=1.00-3.92). In conclusion, low back pain history, knee pain history, prolonged standing, and pronated foot type were important factors associated with foot pain in pre-retirement aged. These findings provide useful information for the development of prevention strategies for musculoskeletal foot pain in this age group. Future studies to determine the cause-effect relationship between foot pain and those important factors are required.

Keywords: Quality of life, Foot pain, Related factors, Older workers

INTRODUCTION

Musculoskeletal foot pain is commonly found among community-dwelling older adults with a prevalence rate of approximately 20-37% [1, 2]. Higher prevalence of foot pain was found among the working population aged 50 and above [3-5]. The main risk factors included poor working posture, general shoe wear, abnormal foot type, and undistributed weight of plantar pressure relating to the weakness of foot and ankle muscles. In addition, toe flexor muscle weakness could reduce the control of body weight shifts during walking attributed to the slow speed of walking. The effect of slow walking speed increased plantar pressure

especially in the toes, which affected both foot pain and the risk of falling [6, 7]. Consequently, foot pain can reduce the quality of life among older adults [5, 8].

Epidemiological information is useful to prevent older workers from occupation-related injury; however, to the best of our knowledge, studies in musculoskeletal disorders at foot region are very few at present. In previous studies, they used only self-reported questionnaires among the working population and there were no physical assessment of the foot structure [2-5]. Therefore, the present researcher wanted to conduct the study in an older worker group, using the Chulalongkorn University as the selected area since almost 35 percentage of all Chulalongkorn University personnel are more than 50 years old. Moreover, a previous study

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revealed a high prevalence of spinal musculoskeletal disorders in Chulalongkorn University personnel had a high prevalence of MSDs [9].

To the best of our knowledge, this is the first study of musculoskeletal foot pain among an older working population. The aims of this study were to characterize the prevalence of MSDs at foot region during the past month in pre-retirement aged of Chulalongkorn University personnel, and to explore the consequence of foot pain with regard to the overall quality of life, as well as to determine the relationship between various factors of socio-demographic occupation, health behavior, and anthropometry and the occurrence of foot pain in this sample group.

MATERIALS AND METHODS

Subjects and procedure

A cross-sectional study was conducted on the staff of Chulalongkorn University between 50 and 60 years of age. The cluster sampling technique was used to select the organizations within Chulalongkorn University. Data collection was done during February and March 2013. A total of 250 participants from 18 organizations agreed to participate in the study. Current inclusion criteria for the subject selection included the personnel of Chulalongkorn University with age 50-60 years. Using a screening questionnaire, 29 participants were excluded. The exclusion criteria were the participants with at least one condition of the following items, i.e. ankle sprain or foot injury from accident during the past month, foot fracture history, foot operation history, foot osteoarthritis, rheumatoid arthritis, gout, diabetes mellitus, cancer, osteoporosis, systemic lupus erythematosus (SLE), and neurological disease. After the screening stage, the remaining subjects were 221 participants in total. The study was approved by the Chulalongkorn University Human Ethics Committee.

Questionnaire

The content of the survey questionnaire in this study was developed based on literature review and a set of standardized questionnaires. A self-reported questionnaire was divided into 6 sections consisting of individuality, work-related physical factors, health behavior, quality of life, history of MSDs, and foot pain assessment. The individuality, work-related physical factors, and health behavior sections were developed based on literature review. Health-related quality of life was adapted from a 12-item short-form health survey (SF-12) Thai

version [10]. The prevalences of MSDs during the last 12 months were collected by Standardized Nordic questionnaires [11]. Also, the prevalence of foot pain during the past month was assessed by the Thai version of Manchester foot pain and disability index [12].

Current individual factors included age, gender, marital status, education level, low back pain, hip/thigh and knee pain history during the last 12 months, and sleeping duration, as well as falling history. Work-related physical factors included job categories, working experience, working duration, general working posture, time spent in each working posture per day (i.e. walking, standing, sitting), environmental factors, and rest break after every 2 hours. Health behavior factors included leisure physical activity, types of exercise, smoking history, general foot care, and general foot wear.

Physical examination

The anthropometric variables in the study were assessed by the physiotherapist including data on body mass index, waist hip ratio, foot problem, types of foot posture, types of foot arch, foot muscles strength, and leg length. Checklist questions that were used to report foot problem [13] consisted of the presence of callus formation, lesser toe deformities, and hallux valgus deformities. The checklist that was adapted from the Manchester scale categorized each hallux valgus deformity into three levels of the severity i.e. mild, moderate, and severe [14]. The measurement of foot posture index (FPI) was previously developed and described by Keenan et al. [15]. They assessed the foot posture with six items. The sum of scores from six items were then used to predict the types of foot posture which consisted of normal foot, pronated foot, and supinated foot. Staheli's arch index (SAI) was also used to describe the types of foot arch from footprint analysis [16]. The value of SAI between 0.44 and 0.89 was defined as normal arch. Therefore, the value less than 0.44 and more than 0.89 was defined as high arch and flat arch, respectively. Foot muscle strength was measured by paper grip test (PGT) for foot intrinsic muscles [17] and manual muscle strength testing of ankle dorsiflexors and plantar flexors for foot extrinsic muscles [18] following the study of Keysor et al. and Menz et al. [19, 20]. Leg length was measured by the distance in centimeters from the greater trochanter to the floor in standing position [21].

Statistical analysis

SPSS software licensed version 17.0 was used for quantitative data analysis in descriptive statistics to present the frequency of each variable and

Table 1 Characteristics of study participants (N=221)

Characteristics	N	%	Mean	SD
Gender				
Male	34	15.4		
Female	187	84.6		
Age			53.2	4.3
Body mass index (kg/m ²)			24.8	4.3
Waist hip ratio			0.87	0.1
Job categories				
Office worker	129	58.4		
Non-office worker	38	17.2		
Lecturer	54	24.4		
Working experience (months)			305.9	88.6
Working duration (hours per week)			47.2	9.8
Participants with foot pain	105	47.5		

Table 2 Health-related quality of life of Chulalongkorn personnel (N=217)

SF-12	Mean (SD)		
	With foot pain (N=105)	Without foot pain (N=112)	Total (N=217)
<i>Health-related quality of life</i>			
SF-12 PCS	42.4921 (7.8642)*	46.3182 (7.4864)*	44.5201 (7.8843)
SF-12 MCS	46.6394 (7.7561)**	49.9911 (6.4457)**	48.4152 (7.2711)

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

** p -value = 0.001 using Independent t-test at significant level p -value < 0.05

inferential statistics to explore the factors related with foot pain. Chi-square analysis and independent t-test were performed first to determine the related factors with foot pain in a bivariate analysis. Then, the factors with p -value < 0.100 were selected for inclusion in multiple logistic regression models. The backward stepwise method was used to calculate adjusted odds ratios and their 95% confidence intervals in the final model. Independent t-test was used to determine the association between health-related quality of life and foot pain. Statistical significance was set at p < 0.05.

Validity and reliability tests

The Index of item-objective congruence (IOC) for the content validity of screening test and questionnaire are acceptable with IOC = 1.00 and 0.79, respectively. The test-retest reliability using Kappa Coefficient and Intraclass Correlation Coefficients (ICC) showed the coefficient ranged from 0.713 to 1.000 for the screening test, while the coefficient ranged from 0.611 to 1.000 for the questionnaire. The intra-reliability test for physical examination test showed a coefficient ranging from 0.651 to 1.00.

RESULTS

The demographic data of participants are shown in Table 1. Almost all of the participants were female

with an average age of 53.2 ± 4.3 (mean $\pm$ standard deviation). The mean of body mass index was 24.8 ± 4.3 kg/m² and the mean of waist hip ratio was 0.87 ± 0.1 . More than half of the participants worked as office workers (58.4%) and lecturers (24.4%) 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. 105 participants (47.5%) were defined as foot pain group in this study.

The association between health-related quality of life and foot pain

Data on 217 participants were used to analyze the association between foot pain and 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 incomplete data. As seen in Table 2, there were significant differences of SF-12 PCS (p -value < 0.001) and SF-12 MCS (p -value = 0.001) between participants with foot pain and without foot pain using Independent t-test at significant level p -value < 0.05.

The comparison of particular factors between foot pain and without foot pain group

The bivariate analysis was used to compare the related factors between the participants with foot

Table 3 The comparison of related factors between the foot pain and without foot pain groups

Related factors	With foot pain		Without foot pain		P-value
	N (%)	Mean (SD)	N (%)	Mean (SD)	
Body mass index		25.4 (4.2)		24.2 (4.3)	0.054*
Waist hip ratio		0.874 (0.1)		0.865 (0.1)	0.415
Low back pain history	71 (58.2)		51 (41.8)		< 0.001*
Hip/Thigh pain history	44 (59.5)		30 (40.5)		0.005*
Knee pain history	77 (62.6)		46 (37.4)		< 0.001*
Falling history	29 (63.0)		17 (37.0)		0.019*
Prolong standing more than 2 hours	31 (56.4)		24 (43.6)		0.091*
Walking more than 2 km per day	47 (50.5)		46 (49.5)		0.277
Lifting more than 5 kg	33 (60.0)		22 (40.0)		0.025*
Rest break after every 2 hours	87 (48.9)		91 (51.1)		0.565
General self-foot assessment	33 (51.6)		31 (48.4)		0.414
General footwear characteristics:					
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
Heel height within 2.5 cm	57 (44.5)		71 (55.5)		0.429
Callus at big toe	21 (38.9)		33 (61.1)		0.144
Callus at forefoot	53 (47.3)		59 (52.7)		0.954
Callus at hind foot/heel	16 (72.7)		6 (27.3)		0.013*
Hallux valgus	36 (37.9)		59 (62.1)		0.013*
Presence of lesser toe deformities	14 (70.0)		6 (30.0)		0.035*
Normal foot type	51 (39.8)		77 (60.2)		0.007*
Pronated foot type	37 (57.8)		27 (42.2)		0.050*
Supinated foot type	17 (58.6)		12 (41.4)		0.199
Flat arch	16 (66.7)		8 (33.3)		0.047*
High arch	18 (46.2)		21 (53.8)		0.852
Normal intrinsic muscle strength	61 (50.8)		59 (49.2)		0.281
Normal ankle plantarflexors strength	20 (36.4)		35 (63.6)		0.034*
Normal ankle dorsiflexors strength	58 (40.8)		84 (59.2)		0.008*
Equal leg length	91 (47.2)		102 (52.8)		0.778

* *p*-value < 0.100 using Chi-square test for categorical variables and Independent t-test for continuous variables

pain (N=105) and without foot pain (N=116). As shown in Table 3, the analysis found 14 factors showing *p*-value < 0.100. The factors were composed of body mass index, history of low back pain, history of hip/thigh pain, history of knee pain, falling history, prolong standing of more than 2 hours, lifting more than 5 kg, callus formation at hind foot/heel, the presence of hallux valgus, the presence of lesser toe deformities, normal foot type, pronated foot type, flat arch, ankle plantarflexor muscles strength, and ankle dorsiflexor muscles strength.

Factors associated with foot pain in pre-retirement aged people

The factors with *p*-value < 0.100 from Table 3 were 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 4 showed the factors related with foot pain at significant level

p-value < 0.05. 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, 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=1.17-11.1, 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).

DISCUSSION

The first aim of the study was to determine the prevalence of foot pain during the past month in pre-retirement aged personnel of Chulalongkorn University. The result showed higher prevalence of

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

Related factors	Bivariate analysis		Multivariate analysis	
	Unadj. OR (95% CI)	P-value	Adj. OR (95% CI)	P-value
Low back pain history				
No	1.00		1.00	
Yes	2.50 (1.72-5.30)	< 0.001**	2.04 (1.06-3.95)	0.034**
Knee pain history				
No	1.00		1.00	
Yes	3.95 (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 (1.00-4.49)	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 (1.00-3.23)	0.051	1.97 (1.00-3.92)	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

foot pain (47.5%) than other studies [2, 3]. The plausible explanation is due to the inclusion criteria of our study which focused on the working population with the shortened range of age 50-60. The previous studies [4, 22] showed high prevalence of foot pain among working population if compared with the studies among general population.

Considering health-related quality of life, the positive and significant association between participants with foot pain and without foot pain was found in the present study similarly to the result of Hill et al., [3] and Menz et al., [20]. The plausible explanation is that the condition of foot pain restricted the activity of daily life i.e. the limitation of walking long distance, standing, avoiding hard or rough surfaces. As a result, the presence of foot pain reduces not only functional capacity but also the overall quality of life including mental health status, social function, and vitality [8]. The factors associated with foot pain in pre-retirement aged were determined using adjusted OR and 95% CI. The significant factors were composed of low back pain history, knee pain history, prolong standing, the presence of hallux valgus, reduced

ankle plantarflexors strength, and pronated foot type.

Low back pain history: The previous studies showed similar results to our study [2, 3]. The mechanism of low back pain might be connected with distal disturbances of lower extremities in the locomotor system [23]. In addition, the foot problem altered the normal gait and normal alignment resulting in the loss of shock absorption which stimulated the emergence of locomotor conditions i.e. low back pain.

Knee pain history: Our results were supported by the previous studies [2, 3]. The excessive loading of the knee can increase the compressive stress of patellofemoral or tibiofemoral joint led to the mechanical stress of ankle joint during ground contact. During the weight-bearing activities, the posture and motion of the knee and foot are coupled within the closed kinematics chain [24]. The excessive rotation of the lower limb at the articulation of knee joint and ankle joint cause knee and ankle/foot pain from overuse injury that may lead to the osteoarthritis of both foot and knee region in the long term effect [25].

Prolong standing: Prolong standing for more than 2 hours increased the risk of blood circulation restriction leading to the swelling at calf muscle and lower extremities injury [26]. The study of Lin et al. [27] among prolong standing workers found that the static posture without ankles and hips movement caused the swelling of leg muscles. The high risk factor of foot pain also increased as a result of the joint compression at lower limb for long time in static standing posture. In sum, the workers should move ankles and hips for the short time period during static standing for 30 minutes to decrease lower leg muscles discomfort [27].

The presence of hallux valgus: In general, the hallux valgus (HV) is the risk factor to develop foot pain since the progressive foot deformity led to the presence of osteoarthritis and foot pain [28, 29]. In contrast, our result showed a negative association i.e. participants who had hallux valgus were more likely to not suffer from foot pain. The current result was similar to that of Nguyen's study. The previous study could not explain any reasons for the negative association [30]. However, the possible explanation for the present study may be related to the data that the participants without foot pain tended to choose more appropriate footwear. As recognizably, appropriate footwear can reduce the risk of foot pain. Those participants with hallux valgus might previously had the experience of foot pain and thus chose more appropriate footwear to reduce their foot pain. The study of Nix et al. [29] revealed that participants with HV had significant concerns about footwear and foot appearance than the participants without HV. This notion might explain the reduced risk factor of foot pain in HV group.

Reduced ankle plantarflexors strength: The results of previous studies supported that a decrease in muscle strength led to the risk factor of foot pain [7]. To our knowledge, the fair degree of ankle plantarflexors strength is not enough to maintain body weight during walking because the push off phase in gait cycle needs higher strength i.e. the good and normal degree to resist the gravity to raise the heel. The reduction of muscle strength would increase fatigue level to maintain body weight during weight-bearing activities, leading to the foot pain related to overuse injury [31].

Pronated foot type: In each gait cycle, normal pronation of subtalar joint occurs after heel strike with the normal range between 4° and 8°. The abnormal pronated foot can affect the compression force acting on subtalar joint, and generate the

abnormal tibial rotation, causing overuse injury on the lower extremities [32]. In addition, excessive foot pronation when normally it should be supination would result in the development of slight discomfort and foot pain or postural symptom. Evidences from some clinical trials show that the correction of excessive pronated foot posture by foot orthotics may reduce knee and foot pain intensity [33].

To the best of our knowledge, this is the first study to determine the factors associated with foot pain among a pre-retirement age group. The major strength of the present study is that the measurement tools using for the study included not only self-reported questionnaire but also physical examination by physical therapists. The information regarding to the association with foot pain is useful for further studies about the prevention and treatment of foot pain. However, the limitations of the present study were found in several points. First, the cross-sectional design could not determine the causal relationship or the risk factors of foot pain. The current result can present only the association among particular factors and foot pain. And due to the limitation of time, we could not reach the target number of sample size. Further studies should use the prospective design to verify the risk factors for foot pain. Second, the recall bias of self-reported questionnaire may be found in the present study. Therefore, the observation or interview method should be used in the future study to decrease wrong recall and wrong understanding of each question. Third, the diagnosis of foot pain was subjective, thus it may lead to inaccurate data. The objective information should be included in the dependent variable to increase more accuracy of data. Last, the participants have the main general working posture of prolong sitting that might not be directly related with foot pain. The future study should emphasize on the workers with prolong standing posture which may be more directly related to the risk of foot pain.

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