CHAPTER II

LITERATURE REVIEW

2.1. Definition of foot pain

Foot pain is usually defined as pain, aching or stiffness in these areas: forefoot, toes, hind foot, nails, ball, heel and arch of foot (Hill et al., 2008; Dufour et al., 2009).

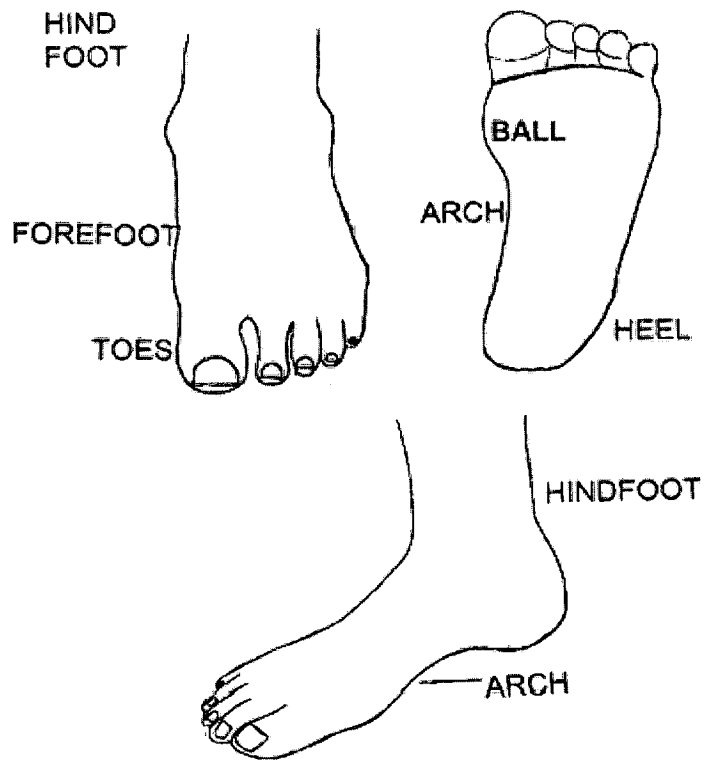

Figure 2: Localized areas of foot pain

(Hill, et al., 2008)

The Manchester foot pain and disability index (MFPDI) was used to assess the severity and impact of foot pain by 3-point scales in each item consisting of none of the time (0 score), on some days (1 score), and on most/every day (2 scores). It had 17 items consisting of functional limitation part (10 items), pain intensity part (5 items), and personal appearance part (2 items). The sum scores of MFPDI varied from the minimum of 0 score to the maximum of 34 scores (Garrow et al., 2000).

The MFPDI was the appropriate tools to evaluate foot pain in clinical and community population including older adults group (Menz et al., 2006; Roddy et al., 2009; Mickle et al., 2011; Spink et al., 2011) because it was found to have high degree of internal consistency (Cronbach's alpha = 0.99). Garrow et al., (2000) defined the subjects with foot pain as the persons who had foot pain during the last month and had at least 1 score of the MFPDI; therefore, the persons who had no foot pain during the last month and had 0 score of the MFPDI were defined as the subjects without foot pain.

The present study used Thai-MFPDI questionnaire. It was measured the test-retest reliability after doing cross cultural adaptation of foot disability questionnaire by Yamsri and Pensri, (2011); the result showed excellent reliability of the questionnaire with the intraclass correlation coefficient (ICC) of 0.96.

2.2. Definition of pre-retirement aged

Pre-retirement age group are the persons between 50 and 60 years of age who have not been stopped employing completely from the workplace (Chuenchoksan and Nakornthab, 2008; Manorath and Maton, 2009).

2.3. Prevalence of foot pain in pre-retirement aged

Foot pain is an important public health issue in older adults because there are increasing the numbers of older persons who are suffering from foot pain in every year (Rao et al., 2012). Foot pain affected about 20-37% among adults with aged over 45 years old (Dunn et al., 2004; Golightly et al., 2011; Thomas et al., 2011). The previous studies showed the higher prevalence of foot pain in older adults among general population. For example, the study of Hill et al., (2008) among general population of the North West Adelaide, found that the people with the highest ratio of foot pain were on aged over 75 years (26.4%), 65-74 years (26.2%), 55-64 years (24.5%), 45-54 years (21.5%), 35-44 years (10.7%), and 20-34 years (10.2%), respectively. Similarly, the study of Messing et al., (2008) among general working population of the Quebec, found that the people with aged between 50 to

65 years have higher significance of foot pain than other age ranges (odds ratio varying from 1.36 to 2.53). The higher prevalence of foot pain was also found in the women group (11.0%) more than men group (8.3%) (Messing et al., 2008).

2.4. Pathophysiology of foot pain

The aetiology of foot pain is widely accepted to be multi-factorial. Increasing age is one of the main factors to induce foot pain because of the weakness of foot and ankle muscles. In addition, toe flexor muscles weakness will reduce the control of body weight shifts during walking which attributed to the slow speed of walking. The effect of slow walking speed increased high plantar pressure especially in toes region which affected both foot pain and the risk of falling in older adults (Hill et al., 2008). Furthermore, the work-related with foot pain are also found in higher proportion among working population (Hill et al., 2008; Messing et al., 2008; Werner et al., 2010). The previous studies revealed the significant association among high physical workload, prolong standing and foot pain. The possible explanation is that poor posture (i.e. prolong standing) can induce musculoskeletal diseases. The continuous loading to muscular structure causes the repetitive injury on the affected area with insufficient time for natural healing process, resulting in the chronic musculoskeletal problems (Wilson et al., 2002; Meijsen et al., 2007).

2.5. Quality of life

Several previous studies found the low level quality of life among older adults with the persistence of foot pain. For example, Hill et al., (2008) found that the persons with foot pain had significant lower scores in all items of health-related quality of life (SF-36) (i.e. physical functioning, role physical, bodily pain, general health, vitality, social functioning, role emotion, and emotional health) than the persons without foot pain. Similarly, the study of Mickle et al., (2010) found the lower scores in people with foot pain. The scores of quality of life have been related

with functional capacity which have tendency to decrease in the older age (Mickle, et al., 2010).

The present study used 12-item short-form health survey (SF-12) Thai version (Chariyalertsak et al., 2011) which were developed from the RAND-36 item health survey (SF-36) by Ware et al., (1996); they found the correlations of 0.76 and 0.89 from the reliability tests in the 12-item Mental component summary (MCS) and the 12-item Physical component summary (PCS), respectively. In addition, the validity tests for the SF-12 MCS and the SF-12 PCS have the range from 0.60 to 1.07 (median = 0.97) and the range from 0.43 to 0.93 (median = 0.67), respectively. The result showed the closely mirrored MCS and PCS measures for the RAND-36 item health survey. Considering the study of Chariyalertsak et al., (2011), they found that SF-12 Thai version have the high internal consistency coefficients of 0.76 equally both of the SF-12 MCS and the SF-12 PCS. The sum scores of each component varies from the minimum of 0 score to the maximum of 100 scores. The previous study revealed that the scores less than 50 represented below-average physical or mental health (Wilson, 2002).

2.6. Factors associated with foot pain

2.6.1 Individual risk factors

a) Age

Age is an important risk factor of foot pain. Increasing age is associated with foot pain (Hill et al., 2008). The previous studies found that aged more than 50 years had significant association with foot pain in older adults (Hill et al., 2008). The main cause of foot pain in older adult aged may be involved with the weakness of foot and ankle muscles. In addition, toe flexor muscles weakness will reduce the control of body weight shifts during walking attributed to the slow speed of walking. The effect of slow walking speed increases plantar pressure especially in toe region which affected both foot pain and the risk of falling in older adults (Hill et al., 2008).

Werner et al., (2010) conducted a study in 407 workers at automotive engine manufacturing plant from five job categories (assembly, admin and engineers, machinists, skilled trades, drivers) in Michigan. They found that the workers with aged over 50 years reported foot pain more than younger workers. Similarly, Messing et al., (2008) found that the working population in Quebec, Canada with aged over 50 years had high significant association (odds ratios varying from 1.72 to 3.97) with ankle or foot pain than other age groups (18-24 years, 25-39 years, and 40-49 years).

Furthermore, the prevalence of localized foot pain is also different in each age group. Hill et al., (2008) found that older group with aged over 55 years had higher prevalence of forefoot and toe pain than younger group. Foot pain in older group may be caused by the deformities and calluses with high plantar pressure areas (Mickle et al., 2010).

b) Gender

Several previous studies have shown that women are higher risk of foot pain than men (Messing et al., 2008; Hill et al., 2008; Werner et al., 2010). Roddy et al., (2011) studied in UK community-dwelling older adults with aged over 50 years and found that the onset of disabling foot pain after 3 years had significant increasing in female but there was no significance in male. The types of shoewear were the main factors affected foot pain in older women (Dawson et al., 2004; Dufour et al., 2009). Dufour et al., (2009) found the association between hind foot pain and the past shoewear. The women who reported the poor shoewear style had higher numbers than the men. Shoewear with heel height more than 2.5 cm affected high plantar pressure which induced foot pain and the risk of falling in older women (Tencer et al., 2004; Mickle et al., 2010).

c) Educational level

Dawson et al., (2002) studied in 127 women with aged 50-70 years. They interested in the educational level and set this factor to be one of the independent variables in the study. They found that there was no significant association between educational level and foot problems. Few evidences studied the

relation between education level and ankle/feet pain. For example, Andersen et al., (2007) studied among workers from industrial and service companies. They found that the low educational level increased onset of hip, knee, and foot pain more than medium educational level and high educational level, respectively.

d) History of MSDs in other areas

Musculoskeletal disorders in body regions especially lower back, hip/thigh and knee pain have an effect on foot pain. There were high prevalence of distal lower-extremity pain (including knee pain, hip/thigh pain and foot pain) among the workers with prolong standing posture (Messing et. al., 2008). The previous studies explained the mechanism of lower-extremities pain from prolong standing posture that the static contraction without mobility during prolong standing caused the lower-extremities muscles fatigue (Iridiastadi et al., 2006) and also affected the venous disorders from blood pooling to lower extremities (Tuchsen et al.,2005).

Several studies found the association between foot pain and other body regions. For example, Hill et al., (2008) found the significant association (p-value <0.001) between foot pain and other joint pains, including lower back, hip, and knee pain. Similarly, Badlissi et al., (2005) adjusted the history of lower back pain, hip pain and knee pain variables as confounding factors in the model to analyze the association between foot health functional status (FHFS) and foot musculoskeletal disorders. As a result, the foot pain may be the cause of generalized body regions pain in the form of osteoarthritis (Garrow et al., 2004)

e) Sleeping Duration

The previous studies showed the association between sleeping duration and musculoskeletal problems. For example, the study of Edwards et al., (2008), found the association between musculoskeletal pain and sleeping duration less than 6 hours or more than 9 hours. Furthermore, there were also the studies about sleeping quality and foot pain. For example, Janwantanakul et al., (2009) studied among office workers and found that there was significant association between foot pain and poor sleeping quality.

f) Falling History

The definition of fall is "the posture with resting on the floor unintentionally with intrinsic muscle activities (Tinetti et al., 1998; Lord et al., 2003). Mickle et al., (2010) categorized the participants with aged more than 60 years into 2 groups which consisting of non-fallers (never fall for the last 12 months) and fallers (have at least 1 time of falling for the last 12 months). The mechanism of falling is caused from the reduction of foot muscle strengths in older adults and induces the stability problem of the shifting weight during walking (Mickle et al., 2011). In addition, the main factors increase falling risk of older people consisting of foot pain, poor balance, total plantar pressure, and types of shoewear.

Falling incidence is mostly found in the older people with foot pain. Badlissi et al., (2005), studied in older persons and found that the types of foot musculoskeletal disorders (i.e. toe deformities, abnormal arch) affected the history of multiple falls. The higher peak pressure and pressure-time integral values at 1st metatarsal head and heel are mostly found in the older adults with foot musculoskeletal disorders which caused the poor balance and coordinated stability led to the risk of falling in older adult (Mickle et al., 2011).

Furthermore, there were several previous studies about the association between falling risk and types of shoewear. For example, Tencer et al., (2004) reported that the shoes with high heel and lesser contact area were higher risk of falling in the older adults. Similarly, Dufour et al., (2009) studied the property of each item and found that the poor shoes such as high-heeled shoes, sandals and slippers had high risk of falling because of the instability structure and lack of support.

2.6.2 Work-related physical factors

a) Job category

Various job categories affect different prevalence of foot pain. Werner et al., (2010) studied at manufacturing plant in Michigan among 407

workers. They found that machinists and drivers had the highest prevalence of ankle or foot pain (63%), the next were assembly (54%), admin and engineers (48%), and skilled trades (38%), respectively. Dawson, et al., (2004) found the association between foot pain and regularly lifting in the occupational activities ($p = 0.03$). As a result, there were association between the occupational postures and foot pain (Dawson et al., 2004; Messing et al., 2008).

b) Working experience

Few evidents studied about time working in the current position. The senior workers had a tendency to presence foot disorders. Werner et al., (2010) found that the workers with time working more than 20 years had higher significance of foot disorders occurrence (82%) than the workers with time working 11-20 years (11%) and 0-10 years (7%), respectively. Similarly, Dawson et al., (2004) found the higher foot pain in the workers with time spent for lifting activities over 30 years than the workers with time spent less than 30 years.

c) Working duration

The previous studies investigated working duration as the risk factors for foot pain. For example, Messing et al., (2008) found that working duration more than 36 hours per week had significant association with high prevalence of foot pain. Pensri et al., (2010) studied the association between working duration and foot pain among saleswomen in Thailand. They found that working duration more than 10 hours per day increased the risk of foot pain. The longer working time can induce musculoskeletal diseases because the continuous loading to muscular structure causes the repetitive injury on the affected area without sufficient time for natural healing process, resulting in chronic musculoskeletal problem. (Wilson et al., 2002; Meijsen et al., 2007).

d) General working posture

General working posture is the main risk factor for work-related with foot pain. Several studies focused on the relationship of foot pain with general posture in the working time. For example, Messing et al., (2008) studied among

general working population. They found that fixed standing posture had higher risk for foot pain (odds ratio varying from 2.56 to 6.10). The saleswomen with static posture of standing also have the association with the risk of foot pain (Pensri et al., 2010). Furthermore, the high physical work load is defined as the potentially risk for musculoskeletal disorders. General physical loading such as lifting more than 5 kg and walking more than 2 km has significantly increased MSDs (Wiktorin et al., 1993). Fjell et al., (2007) found that forward-bending position, twisted position, and lifting had significant association with the prevalence of musculoskeletal pain. Similarly, Pensri et al., (2010) found the association between lower extremity pain and lean forward bending, stair climbing, heavy objects pulling, and body twisting. The positive relation were found in the study of Messing et al., (2008) and Andersen et al., (2007) that heavy loads lifting and repetitive movements had significantly increased the risk of foot pain. The poor working posture induced higher load and caused the injury to the lower extremities region, resulting in development of musculoskeletal diseases (Meijsen et al., 2007).

e) Time spent in different postures

Previous studies showed the increasing risk of foot pain in workers. Regularly working in static posture increases the risk of foot pain. Pensri et al., (2010) found that prolong standing in saleswomen more than 10 hours per day have significant association with foot symptom. Similarly, there were association between prolong sitting and lower extremity pain in office workers (Janwantanakul et al.; 2009). The positive relationship was also found in the study of Messing et al., 2008; there were association among prolong standing, general walking for long distance and foot pain in Quebec working population. Prolong standing and walking caused the workload of leg, pelvic, back muscles which were the important structures to maintain balance and posture. The continuous bearing forces to lower extremities induced high pressure and injury to the joints. (Wilson, 2002; Meijsen et al., 2007).

f) Working environment

Previous studies showed that physical working environment were the main risk factors induced musculoskeletal pain. For example, Janwantanakul et al., (2009) studied among office worker and found that the environment conditions such as temperature, noise, air flow, and lighting had directly affected musculoskeletal pain with lower extremity region. Similarly, Pensri et al., (2010) also found the association between self-perception of environment conditions and lower extremities pain. The temperature and lighting had significant association with lower extremities pain.

g) Rest break

The time break during working for long time period can reduce musculoskeletal pain (Dababneh et al., 2001; Tucker et al., 2003; Rogers et al., 2004; Tucker et al., 2006; Janwantanakul el al., 2009; Pensri et al., 2009). The study of Tucker et al., (2006) found that the accumulation of sustain activities more than 2 hours increased the risk of musculoskeletal pain; therefore, rest break duration at least 10 minutes after 2 hours of continuous working can reduce the occurrence of MSDs. The study of Pensri et al., (2009) among saleswomen in Thailand found the significant association ($p<0.012$) between foot pain and hardly rest break. The rest break are very important for the workers with prolong static pressure. The continuous loading to the joint especially in knee region and foot regions induced pain and injury to the joints (Wilson, 2002; Meijsen et al., 2007).

2.6.3 Health behavioral factors

a) Leisure physical activity

Few studies reported the association between foot pain and physical activity. The previous studies showed that workers with sedentary physical activity had significantly increased lower-leg or calf pain (odds ratio varying from 1.09 to 2.00) more than the workers with leisure physical activities at least 20 minutes per time (Messing et al., 2008). There was no study reporting significant difference

between level of physical activities and foot pain. However, Hill et al., (2008) studied in the South Australia and found that there was the higher percentage of foot pain subjects with sedentary physical activity (20.8%) than the foot pain subjects with some level of activity (16.4%). Similarly, Werner et al., (2010), the studying in Michigan, reported that the workers without foot diseases had higher percentage of regularly exercise (67%) than the workers with foot pain (64%). As a result, there was no significant difference between physical activity and foot pain in the previous studies because some kinds of physical activities may affect the physical loading to foot muscles which are the main risk factors of foot pain. There was no report about the association between different types of leisure physical activities and foot pain.

b) Smoking habit

Current cigarrete smokers have higher risk for musculoskeletal disorders than non-smokers. Andersen et al., (2007) studied with general working population in Western Denmark and found the higher prevalence of hip, knee, foot pain in smokers. Similarly, Fjell et al., (2007) studied with employee in the Swedish public sectors and found the significant association between musculoskeletal disorders and smokers both men and women (men odds ratio varying from 1.1 to 6.2, women odds ratio varying from 1.1 to 1.8). Smoking is the cause of general damage to musculoskeletal tissues (i.e. cramp in calf muscles, numbness of hands and feet) through vasoconstriction, hypoxia, defective fibrinolysis or other mechanisms that impair their nutrition circulating to the distal of hands and feet (Leino-Arjas, 1998).

However, the opposite effects were found in the previous studies involved with foot pain. For example, Dufour et al., (2009) studied the association between smoking status and foot pain among older adults with aged more than 50 years. The authors found that current cigarette smoker, former smoker, and nonsmoker had no significant difference with the prevalence of foot pain. Similarly, Werner et al., (2010) studied among the assembly plant workers and found that the workers with and without current smoking had no significant difference in foot

discomfort. However, the result showed the higher proportion in smoking workers with foot disorders (21%) than smoking workers without foot disorders (15%).

c) General footwear

General types of footwear are important factors to affect foot problems. The appropriate footwear can reduce foot pain and the risk of falling in older adults (Menz and Sherrington, 2000). Menz and Sherrington, (2000) considered the components of suitable footwear which were composed of heel counter softness, adjustable fixation, normal heel height, sole flexion point, firm insole, and appropriate size. Dufour et al., (2009) categorized the types of shoewear into 3 groups which consisting of

- The "Good" groups were low-risk shoes with softer out-sole, mid-sole, firm of contact surface and rigid heel counters such as casual sneaker and athletic shoe.

- The "Average" groups were mid-risk shoes such as Rubber sole shoe, work boot, cowboy boot, hard soled leather shoe, and special shoe.

- The "Poor" groups were high-risk shoes without support and stability structure such as high-heeled shoes, sandal, and slipper.

The "Good" shoes decreased the risk of foot pain. Dufour et al., (2009) found the significant difference of hind-foot pain between the good shoes and the average shoe (p-value = 0.022). There was no significant difference of hind foot pain between the average shoe and poor shoe because few subjects reported the poor shoewear in general. Dawson et al., (2004) reported the past shoewear with the highest heel worn regularly for going out socially and for work led to the foot problems in older women. The past shoewear worn regularly with heel height over 2.5 cm caused the formation of plantar calluses and hallux valgus in older women (Menz et al., 2005). The high-heeled shoes decreased the plantar contact area. The body weights distributing to foot were not equally in each region which caused appearance of foot pain especially in hind foot region (Dufour et al., 2005). Furthermore, the lower sole/surface contact area in high-heeled shoes decreased the

stable base of support led to the incidence of falling in older adults (Tencer et al., 2004). As a result, safe shoe can prevent the risk of falling in older people.

d) General foot care

Foot problems are often found in older adults. General self-foot care can reduce the risk factors for foot pain and falling problem in older adults (Mitty, 2009; Spink et al., 2006). The podiatry care which consisted of appropriate foot wear/orthotics, foot exercise program, callus care, and skin care decreased the prevalence of falling and disabling foot problems in older adults (Spink et al., 2006). The older adults with improper shoe wearing induced the toe deformities problems, callus formation, and balance problem (Chaiwanichsiri et al., 2008). The previous studies showed the decreasing of foot pain among older adults with general self-foot care (Frey, 2000; Spink et al., 2006; Wilson et al., 2008; Chaiwanichsiri et al., 2008). Therefore, foot care program for preventing falling and decreasing foot pain are necessary to decrease general foot problems among older adults.

2.6.4 Anthropometric Variables

a) Obesity Index

Obesity is the main risk factor which directly affected foot pain. The increasing BMI especially in the obese group (BMI $\geq$ 30 kg/m2) have significant association with foot pain in the working population (Messing et al., 2008). Similarly, Hill et al., (2008) found the significant association between obese group and prevalence of foot pain (odds ratio varying from 1.57 to 2.31) using the measurement of body mass index and waist hip ratio. The previous studies (Hodge et al., 1999; Mickle et al., 2010; Spink et al., 2011) showed the association between foot pain and plantar pressure. Increasing body weights causes the high plantar pressure which induces foot pain in older adults (Menz et al., 2006).

Conversely, a few previous studies showed the opposite effect. For example, Dawson et al., (2004) conducted the study in older women with aged 50-70 years and found that the higher risk of corn/callus information were found in

lower body mass index women. Werner et al., (2010) found that there was no significant association between high prevalence of foot pain and obesity. However, the study showed the inclination of foot pain incidence higher in the heavier group.

b) Foot problem assessment

Foot problems affected older people up to 80% (Benvenuti et al., 1995; Kruizinga et al., 2002; Keysor et al., 2005). The previous studies showed the association between foot pain and foot problems (Dunn et al., 2004; Badlissi et al., 2005). Foot problem assessment followed by the study of Menz et al., (2001) consisted of the presence of callus formation, lesser toe deformities (claw toe, hammer toe, mallet toe), and hallux valgus deformities (the deviation of big toe caused the protrusion of the first metatarsophalangeal joint which can induce pain and discomfort at that area) which were composed of three levels using the Manchester scale i.e. mild, moderate, and severe (Garrow et al., 2001). The presence of toe deformities increased plantar pressure in specific area and directly related to the hyperkeratotic lesions especially under the 2nd MPJ which were found to be the most common area (Merriman et al., 1987; Spink et al., 2009). The effects of foot problems were more likely to have foot pain in older people (Benvenuti et al., 1995; Menz et al., 2007).

c) Foot posture Index (FPI)

The foot posture was assessed by the study of Redmond et al., (2006). The scores from FPI indicated the types of foot which consisting of pronated foot, supinated foot, and neutral foot. There were significant associations between abnormal foot posture and subjects with foot pain from the previous studies (Sneyers et al., 1995; Burns et al., 2005; Crosbie et al., 2006; Irving et al., 2007). FPI was found to be suitable for clinical assessment with good internal construct validity in the finalized version of FPI-6 after re-analyzing FPI-8. Good item-trait interaction was shown on the data presenting good overall fit in the mode. The pearson-fit separation index (PSI) and Cronbach's alpha had the good internal consistency with the measurement (PSI= 0.88; Cronbach's alpha = 0.87) (Keenan et

al., 2007). The study of Morrison and Ferrari, (2009) also showed the high inter-rater reliability of the test (Kappa analysis = 0.06).

d) Staheli's arch Index (SAI)

The previous studies showed the association between abnormal arch and foot pain (Garrow et al., 2004; Badlissi et al., 2005; Hill et al., 2008). SAI was first described by the study of Staheli et al., (1987). The previous studies used SAI to measure the types of arch from footprint analysis (Gross et al., 2011; Mahdi and Mahmood, 2006; Hernandez et al., 2007; Janchai et al., 2008). The study of Papuga and Burke, (2011) showed the highest interrater reliability of SAI with ICC of 0.975 among other measurement tools for footprint analysis which were composed of the Chippaux-Smirak index, the arch angle, and the arch index. The positive correlation ($p < 0.05$) between radiological measurement and SAI indicated that the increasing talo-horizontal angles had an increasing effect on SAI (Kanatli et al., 2001). These findings revealed that footprint analysis could be used effectively to describe the types of medial longitudinal arch of foot (Kanatli et al., 2006). 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 (Onodera et al., 2008).

e) Muscle strength testing

Toes deformities are always found in older adults because of the weakness of foot and ankle muscles (Menz et al., 2006). The consequence of toe flexor muscles weakness will reduce the control of body weight shifts during walking, resulting in the slow speed of walking. The effect of slow walking speed increases plantar pressure especially in toe region which affected both foot pain and the risk of falling in older adults (Hill et al., 2008). The muscle strength measurement used manual muscle technique for extrinsic foot muscles and paper grip test for instrinsic foot muscles followed by the study of Keysor et al., (2005) and Menz et al., (2006), respectively. The intrarater reliability were assessed in the pilot study and shown very good agreement of kappa level with the kappa

coefficient of 0.931 for ankle plantarflexors testing, 0.850 for ankle dorsiflexors testing, 1.000 for PGT1, and 0.902 for PGT2 (APPENDIX VIII).

f) Leg length measurement

The previous studies showed the association between foot posture and leg-length discrepancy (Finestone et al., 1991; Korpelainen et al., 2001; Rothbart, 2006; Elbaz et al., 2009). The abnormal foot posture expecially foot pronation had a direct effect on the anterior movement of innominate bones. The consequence of abnormal alignment led to the bone shift of acetabula in upward and backward rotation which was related with knee hyperextension and leg shortening. As a result, the inequality of leg had an association with foot pain due to the abnormal foot posture (Rothbart, 2006). The study of Korpelainen et al., (2001) showed the significant association between the frequency of lower limb fractures and leg-length discrepancy in the athletes group. The limb dominance with a greater use was the main risk factor for lower limb injury (Finestone et al., 1991).