

**Original article:**

## Determining the impact of prolonged standing on foot morphology- correlative study

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### Abstract

**Introduction:** The purpose of this study is to see the impact on foot morphology that affect changes in the foot type or loading response (pronation / supination) of the foot and ankle with prolonged standing. Among those who work standing, patterned differ by proportion of time standing and years or months. This study aims to measure the change in foot posture or type by accessing and giving score using FPI-6 tool i.e Foot Posture Index whether the foot is pronated or supinated and related injuries that have chances to occur further in prolonged standing workers or individual and to find out the change in foot posture or type and see related changes in foot characteristics that leads injuries related to foot and ankle by using FPI-6 score.

**Methodology:** Total 70 males and females between 21-45 years voluntarily participated and performed FPI-6 observational analysis. The FPI-6 is performed by positioned in relaxed standing with each foot. The examiner ensured the participant is comfortable, facing ahead and evenly balanced before commencing and then positioned themselves in kneeling behind the foot being scored.

**Result:** Correlation of right and left foot with timing hours that indicated that changes in morphology of one foot will lead to the other foot later on. Correlation of right and left foot with timing hours is (rt.foot 0.97>0.96 lt.foot) .

**Conclusion:** The result of the study suggest that a significant change in the foot structure of the people who are standing for prolonged hours with years or months. This study emphasize the importance of not to stand for prolonged hours continuously for a long period of time and hence reduce anatomical changes in the foot or reduced musculoskeletal related injuries. For standing prolonged hours, it changes the anatomical view or structure of the foot that leads to foot pronation and supination and increase the risk of musculoskeletal disorders of the foot. The study shows that foot structure goes in pronation those who stand for prolonged hours with minimum one to two years experience. These people have high chances of foot deformity and flat foot posture or reduced medial arch height that strains the muscles of ankle and cause pain which change the foot type by changing their foot position and increases the load on foot.

**Keywords:** Posture, Foot Posture Index, Foot Function

### Introduction

To measure changes in foot structure and related parameters during about prolonged standing it is important to clearly outline methods and reliability of measures to be used. Proposed mechanism that might lead to change in foot posture include alterations in foot and ankle which contribute to maintenance of medial longitudinal arch height. Reliability defined using the ICC can be graded where <0.4=poor; 0.4-0.59=fair; 0.60-0.74=good; and 0.75-1.00=excellent. Prolonged standing is something that is found in various types of service/occupation like food

caterers, photocopy operators, sales clerk, who work in health departments as well as many factory jobs and majorly seen in security guards and teachers. (1) Working in standing position for prolonged hours can be linked to versatility because the mobility of legs position and having large degree of freedom. Standing for a prolonged hours or duration can lead to discomfort, muscle fatigue and occupational injuries to workers(2) . If the standing position is continuously practiced for months or years than it can affect all lower limb muscles efficiency and discomfort or changes in foot or ankle type or characteristics of foot. As long term consequences, not only foot type or characteristics changes but also severe health problems also have chances to occur such as venous return, swelling in feet, disorders like venous disorders, circulatory disorders and other musculoskeletal disorders and chances of degenerative damages in ankle or feet .There has been a long-lasting interest in the health consequences of constrained standing , due to discomfort suffered by the workers found that laundresses who worked standing had a four -fold excess of leg ulcerations compared to other women workers. (3). For instances, for the duration of maximum eight or twelve hours time period daily in a job , the higher rating of discomfort was obtained in feet or ankle which changes the foot type of a person. Joint movements are facilitated by synovial fluid as a lubricant within the joints and due to the normal ageing process, the quantity of synovial fluid decreases, resulting in stiffness and less flexible motions of joint. (4)The FPI is a system for observing and rating static foot posture, incorporating 8 criteria with the subject standing relaxed in a bipedal position include Talar head palpation , supralateral and infralateral malleolar curvature , Helbing's sign , Frontal plane alignment of the calcaneus , Prominence in the region of the talonavicular joint , Congruence of the medial longitudinal arch , Congruence of the lateral border of the foot and Abduction/adduction of the forefoot on the rearfoot . (5)

### **Aims & Objectives**

As the aim is to see impact on foot morphology affect changes in the foot type or loading response (pronation / supination) of the foot and ankle with prolonged standing. Among those who work standing , patterned differ by proportion of time standing and years or months. This study aims to measure the change in foot posture or type by accessing and giving score using FPI-6 tool i.e Foot Posture Index whether the foot is pronated or supinated and related injuries that have chances to occur further in prolonged standing workers or individual and to find out the change in foot posture or type and see related changes in foot characteristics that leads injuries related to foot and ankle by using FPI-6 score.

### **Material & Methods**

This study was designed as a correlative study. We reviewed 70 young male and females . we obtained age , sex , body weight , height , underlying disease and other information.

### **Exclusion criteria**

The following exclusion criteria were applied to the subjects such as joint pathology, musculoskeletal disorders, diabetic person, any local trauma, any surgery and pain associated with gait.

### **Foot Posture Index**

The FPI is a clinical tool that quantifies the degree to which a foot is pronated or supinated . (6,7) It is a relatively simple and rapid method with good reliability . the FPI was evaluated in standing population using original protocol with the six items shown below 1) talar head palpation , 2) curvature at the lateral malleoli, 3) inversion / eversion of

the calcaneus ,4) talonavicular bulging , 5) congruence of the medial longitudinal arch , and 6) abduction /adduction of the forefoot on the rarefoot . (8)

Table 1: Foot Posture Index Scoring

	0	1	2	3	4	5
1) Talar head palpation	Like foot posture on lateral side but not medial side	Like foot posture on lateral side but not medial side	Like foot posture on lateral side but not medial side	Like foot posture on lateral side but not medial side	Like foot posture on lateral side but not medial side	Like foot posture on lateral side but not medial side
2) Supra & infra lateral malleolar curvature	Curvature like normal	Curvature like normal	Curvature like normal	Curvature like normal	Curvature like normal	Curvature like normal
3) Inversion/eversion of calcaneus	Calcaneus like normal	Calcaneus like normal	Calcaneus like normal	Calcaneus like normal	Calcaneus like normal	Calcaneus like normal
4) Bulging in talonavicular joint	Like foot posture on lateral side but not medial side	Like foot posture on lateral side but not medial side	Like foot posture on lateral side but not medial side	Like foot posture on lateral side but not medial side	Like foot posture on lateral side but not medial side	Like foot posture on lateral side but not medial side
5) Congruence of the medial longitudinal arch	Like foot posture on lateral side but not medial side	Like foot posture on lateral side but not medial side	Like foot posture on lateral side but not medial side	Like foot posture on lateral side but not medial side	Like foot posture on lateral side but not medial side	Like foot posture on lateral side but not medial side
6) Abduction/adduction of the forefoot on the rarefoot	Like foot posture on lateral side but not medial side	Like foot posture on lateral side but not medial side	Like foot posture on lateral side but not medial side	Like foot posture on lateral side but not medial side	Like foot posture on lateral side but not medial side	Like foot posture on lateral side but not medial side

Fig.1: The six items of the Foot Posture Index



**Observation & Result**

The above table shows that BMI with 26.01kg/m<sup>2</sup>. Though, FPI of right foot shows 4.98 average whereas FPI of left foot shows 3.84 mean average.

Table 2: representative of BMI and FPI of right and left foot mean and standard deviation.

	MEAN ± SD
BMI(kg/m <sup>2</sup> )	26.01± 4.61
FPI RIGHT FOOT	4.98±2.07
FPI LEFT FOOT	3.84± 2.05



Figure 2 : showing deviation in inversion / eversion of calcaneus

### Discussion

This study focused on the impact on foot while standing for prolonged hours with respect to few months or years and reported the differences on the foot by measuring with FPI-6 scoring grade. A significant difference is seen in the foot type based on the Foot Posture Index. As the result from the above reliability studies shows that the FPI-6 have excellent reliability in this thesis strong positive correlation of right and left foot with timing hours (rt.foot 0.97>0.96 lt.foot)(9) and are more reliable than reports in the literature except for studies where collaborative training was undertaken as part of the research protocol as in the current study. (10) And the persons who are standing for prolonged hours shows pronated foot type. These people have high chances of foot deformity and flat foot posture or reduced medial arch height that strains the muscles of ankle and cause pain which change the foot type by changing their foot position and increases the load on foot . The mean value from this reliability study was  $4.98 \pm 3.84$  mm . (11)

### Conclusion

This study shows a significant change in the foot structure of the people who are standing for prolonged hours with years or months. This study emphasize the importance of not to stand for prolonged hours continuously for a long period of time and hence reduce anatomical changes in the foot or reduced musculoskeletal related injuries. For standing prolonged hours , it changes the anatomical view or structure of the foot that leads to foot pronation and supination and increase the risk of musculoskeletal disorders of the foot.

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