



Assessment of Foot Posture in school going children aged 5 – 12 years: A cross sectional study

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Abstract

Introduction: Foot is the most important part of mobility and balance in our body. Children's feet can grow anatomically and functionally based on both internal (sex, age, and heredity) and external (environmental) factors. Unfortunately, foot problems are common, and affecting millions of people around the world.¹ Understanding the significance of proper foot alignment and adopting strategies to maintain it can have a profound impact on our overall health. In this study, we will explore the importance of foot posture awareness and how it can contribute to a healthier, pain-free life. **Objectives:** To assess the foot posture and foot arch in school-going children aged 5-12. **Methods:** Foot posture index and Chippaux- smirak index was use in school going children to assess foot posture and foot arch type. **Conclusions:** There is no effect of anthropometric measure on foot posture and the percentage of individuals with pronated feet was high. It was observed that the development of foot arches begin by the age of 7 years.

Keywords: foot; pronation; supination; foot posture; school going children.

Introduction: Foot is the most important part of mobility and balance in our body. Children's feet can grow anatomically and functionally based on both internal (sex, age, and heredity) and external (environmental) factors. Unfortunately, foot problems are common, and affecting millions of people around worldwide(1). Understanding the significance of proper foot alignment and adopting strategies to maintain it can have a profound impact on our overall health. In this study, we will explore the importance of foot posture awareness and how it can contribute to a healthier, pain-free life.

Our feet are the foundation on which we stand and walk. Just like a building relies on a strong foundation, our body's stability, balance, and posture depend on the alignment and strength of our feet. Poor foot posture can lead to a chain reaction of misalignments throughout the body, affecting the ankles, knees, hips, spine, and even the neck.

Foot posture problems include high arches (supination), flat feet (overpronation), and other variations. Each ailment has a unique combination of signs and symptoms as well as effects on general health. For instance, supination can result in ankle sprains, stress fractures, and lower back pain, whereas overpronation can result in ankle instability, knee pain, and hip misalignment. Individuals can take proactive measures to address these issues and lessen their impact by being aware of them.²

Foot problems can cause discomfort or pain in the feet themselves, yet they can also make various areas of the body more susceptible to problems.³ By becoming more conscious of their foot position, people can detect possible sources of pain and seek suitable interventions to relieve discomfort. For instance, poor foot posture can result in problems like shin splints, Achilles tendonitis, and even lower back pain.^{4,5} The objective of this study is to assess the foot posture and foot arch in school-going children aged 5-12 years.

Need of study - Foot posture refers to the alignment and positioning of the feet in relation to the lower limbs and the ground. It plays a crucial role in the development of a child's musculoskeletal system, gait mechanics, etc. Understanding and assessing foot posture in children is essential because it can have implications on their physical health, functional abilities, and participation in physical activities.

The development of foot posture is important during childhood as it establishes a foundation of biomechanical alignment of body.

Assessing foot posture in school-going children involves a comprehensive evaluation of the alignment, structure, and function of their feet. Clinical evaluation of foot, is essential in identifying abnormalities of foot posture, and it will help to understand the foot arch development.

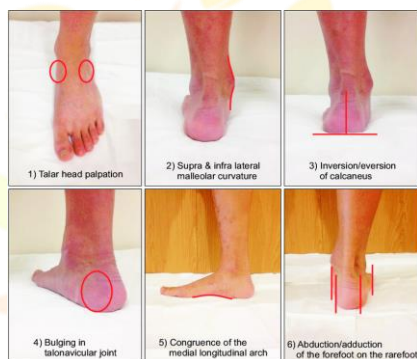
Methodology:

This is a cross sectional study that was carried out in 40 primary and high school children for one month. They were decided using purposive sampling. After obtaining permission from the Institutional Ethics Committee, written and informed consent was obtained from the parents and the school authorities. The children were with symmetrical feet, with no evident joint deformities aged 5- 12 years were included whereas the children with foot pain, injury of the lower limbs during the past six months, congenital abnormalities, neurological diseases and history of foot surgery were excluded. They were divided according to their age and after explaining the procedure their samples were collected.

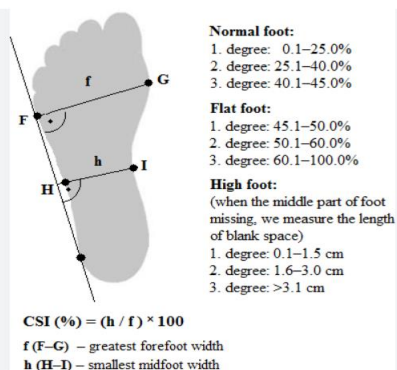
Outcome measures

1. Foot posture index:

Foot posture was quantified using the Foot Posture Index – 6 items (FPI-6). Participants stood in a relaxed bipedal stance position, and six observations (talar head palpation, supra- and infra- lateral malleolar curvature, prominence of the talonavicular joint, congruence of the medial longitudinal arch, abduction/adduction of the forefoot, and inversion/eversion of the calcaneus) were documented. Each of the six items was awarded a score ranging from – 2 to + 2, with the six items summated to produce a final score ranging from – 12 to + 12. Higher scores represent a more pronated foot posture.¹²



2. Chippaux-smirak index: The Chippaux-Smirak index is defined as the ratio of the length of line B, a line parallel to A at the narrowest point on the foot arch, to the length of line A, the maximum width at the metatarsals ($B/A \times 100, \%$). The ratio is then compared to the following values: Normal arch: 25% - 45%, Flat arch: >45%, High arch: <25%.¹¹



Procedure:

Participants were screened on the basis of inclusion and exclusion criteria. Children who fulfilled the inclusion criteria were then included in the study. Information of the outcome measures was given. Children were made to march 10 times at the very place and then their posture was assessed using the Foot Posture Index. According to the Chippaux- Smirak Index the children were made to stand on a carbon paper and the print of their sole was documented. The documented values of both the scales were noted for statistical analysis.

Result:

Table 1. Demographic details of participants

Demographic data	Mean ± SD
Age	8.825± 1.855903
Height(cm)	114.95± 6.11126
Weight(kg)	26.2± 3.018278
BMI (kg/m²)	20.3175± 2.48027

Foot posture	Normal	Flatfoot	High arch
Neutral (n=17) 3.10 ± 2.15	9 (44.66±1)	8 (64.9±4.77)	-
Pronated (n=23) 6.33 ± 0.73	0	68.2 ±7.3	-
Supinated (n=0)	-	-	-

approximately 8.825 years, with a standard deviation of approximately 1.856.

Height: The average height of the participants is 114.95 cm and the data has a standard deviation of approximately 6.111.

Weight: The average weight of the participants is 26.2 kilograms, with a standard deviation of approximately 3.018.

BMI: The average Body Mass Index (BMI) of the participants is 20.3175 kg/m², and the standard deviation is approximately 2.480.



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Table 2: Distribution of posture by Foot Arch Type

The table shows the Foot Posture Index (FPI) and the arch type. It shows that 23 participants are having pronated foot posture with a mean of 6.3 ± 0.73 . Among them, 23 individuals had flatfoot arch type (68.2 ± 7.3). There are no participants with supinated foot posture. 17 participants in the studied population had neutral feet with mean SD of (3.10 ± 2.15). Among them 9 had Normal foot posture (44.66 ± 1), and 8 of them had Flatfoot foot posture (64.9 ± 4.77).

DISCUSSION

The development of flatfoot is linked to the collapse of the medial longitudinal arch brought on by abnormal foot bone structure or the relaxation of muscle ligaments. According to the literature, a pronated foot is characterized by a physiological collapsed or flattened arch, and it can have implications on the alignment of the lower extremities, potentially leading to issues like ankle instability and knee pain. But in addition to physiology, a variety of outside influences can have an impact on flat feet.⁶ Liya Xu et al. found that there were several risk factors for the identification of flatfoot in youngsters, being under nine years old, joint relaxation, wearing sports shoes, being a child living in an urban setting, and getting less exercise. It was discovered that flatfoot affected fewer girls than boys, and that the percentage of flatfoot fell with age. the growth of children's medial longitudinal arch (MLA). During walking and running, the MLA is a crucial foot part that helps in shock absorption and weight bearing. According to Jasper W.K. et al., children's MLA stays constant between the ages of 7 and 9 and may be impacted by the child's sex and the kind of shoes they wear as a youngster.⁷

The demographic details of the participants showed that the average age of children were approximately 8.825 years. The Gender distribution indicated that around 55% were male, and 45% were female. The average height, weight, and BMI of the children were 114.95 cm, 26.2 kg, and 20.3175 kg/m², respectively.

Using the Foot Posture Index (FPI), we found that 23 out of the 40 participants exhibited a pronated foot posture. Seventeen participants in our study had a neutral foot posture, indicating that their foot alignment falls within a more typical range. This is in line with the study done by Liya Xu et. Al that stated that all of the subjects were of preschool age, the incidence of flatfoot would increase. With the increase in age, the incidence of flatfoot would gradually decline, which would also agree with the physiological development norms seen in foot arches. However, the development of the foot arch might not be a continuous development process, similar to the growth patterns of height or weight. The foot structure may change when children develop new motor skills or ambulation.

Interestingly, none of the participants in our study displayed a supinated foot posture, which indicates an abnormally high arch. While a supinated foot posture is less common, it can be associated with increased risk of injuries such as ankle sprains and stress fractures.⁸

Physical activity is essential for overall health, but it can also result in injuries that impair one's quality of life. There are several reasons why injuries can happen, including poor technique and foot position. Ankle injuries can be caused by foot posture, which can have a major effect on the lower limb. A number of ailments, including low back pain, degenerative joint disease, hallux-valgus, general lower limb pain, patellar tendinitis, and foot pain, can result from pronated feet, where the arch of the foot folds inward. Ankle sprains and iliotibial band syndrome are positively correlated with a supinated foot type, which has a high arch.⁸

The assessment of foot arch types using the Chippaux-Smirak Index revealed that 31 out of 40 participants had flatfoot. children who have high arched, flat feet are more likely to get foot injuries from running. Overpronation, or excessive inward rolling of the foot, can result from flat feet and put more strain on the foot and ankle. On the other hand, excessive rolling outward of the foot (supination) caused by high arched feet can result in instability and a higher risk of ankle sprains.⁹

Remarkably, none of the participants in our study had a high arch according to the Chippaux-Smirak Index. High arches, also known as cavus feet, can lead to their own set of challenges, including a higher risk of ankle sprains and stress fractures. The absence of high arches in our study population reflects higher prevalence of pronated foot arch and a moderate prevalence of neutral foot arch types in the studied population.

Implications and future scope:

The findings of this study highlight the importance of assessing and monitoring foot posture and arch types in school-going children. Understanding these factors early in life can help identify individuals at risk of developing musculoskeletal issues or discomfort. It also provides an opportunity for early intervention and education on maintaining healthy foot posture.¹⁰

Future research in this area could focus on longitudinal studies to track changes in foot posture and arch development over time and type of foot wear. Additionally, educational interventions and exercises targeted at improving foot posture in children could be explored to promote overall musculoskeletal health.

conclusion, our study revealed that there is no effect of anthropometric measure on foot posture. And at the age of 7 development of foot arch begins. In children who walk or play mostly bare foot the arch was more developed than who wore shoes. It is our hope that this research contributes to a greater understanding of the importance of foot health in childhood and its long-term implications.

Conflicts of interest: There is no conflict of interest

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