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The cause and frequency of PES Planus (Flat Foot) problems among young adults

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ABSTRACT

Background: Pes planus, also known as flat foot, is one of the most commonly seen foot deformity. It is characterized by a very low or an absent arch, which is the main supportive structure of the foot. Pes planus deformity is associated with impaired foot movements and increased frequency of pain and discomfort. **Aims and Objectives:** The present study was carried out to estimate the prevalence of pes planus among young healthy individuals in South Indian population. **Materials and Methods:** This cross-sectional study was carried out among 500 individuals (168 males and 332 females) between the ages of 18 and 25 years. The feet of all subjects were visually inspected and footprint screening test was carried out. **Results:** The prevalence of pes planus among the study subjects was 29%. The highest prevalence and pattern of age wise distribution of pes planus was observed in 20 years (24%), followed by 18years (16%), 19& 21years (14%), 23years (13%), and 22,24&25 years (10%,6%,3% respectively). **Conclusion:** Regular screening and monitoring of this foot deformity would create awareness about foot problems and can guide care givers to provide suitable footwear for persons with pes planus. It is advisable to conduct early screening so as to reduce the flatfoot progression into the adulthood and would assist better in their physical activities.

Key words: Adults; Pes planus; Foot deformity; Normal foot

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INTRODUCTION

Human foot is a complex segmented structure comprised of 26 bones held together by ligaments, extrinsic tendons and intrinsic muscles.[1] The feet are subjected to many frictional forces during daily activities, including balancing of the body weight for which, the feet should act as a stable pedal platform capable of spreading stresses. They also act as a lever to resist thrust during walking, running and jumping. Longitudinal arch of the foot is one of the parts that play a role in the biomechanics of the foot to keep the feet more stable as it stands, strides, distributes the weight evenly over a wider area, increases speed and swiftness during walking and provides stability and flexibility. The longitudinal arch is formed by the tarsal, metatarsal, ligament and tendon bones.[2] Based on the structure of the longitudinal arch, the shape of the sole of the human foot is divided into three categories normal foot, flatfoot and cavus foot.[3]

Any alteration in the anatomical disposition of the foot leads to deformities of the foot such as flat foot, commonly known as pes planus.[4] Pes planus is a complex deformity commonly seen in clinical practice. It is characterized by a combination of a collapse of the medial longitudinal arch, foot abduction, and hind foot valgus.[5,6] It is a medical condition in which the arc showing the length of the leg is flattened outwards or downwards. Pes planus may affect either of the legs or both, and not only increases the weight of leg that acts on the leg structure, but also interferes with normal foot function. As a result, those with a pes planus experience difficulty in foot movements during prolonged

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periods of time. The symptoms of the pes planus include softness of the plantar aspect of the foot, collapse of the ligaments, rapid fatigue of the leg, pain with pressure and instability of the middle structure of the feet.[4]

The development of foot arch is brisk between the age of two and six years. It becomes structurally perfected around the age of twelve to thirteen years. Pes planus may be noted early in life. It may be diagnosed if the arch is collapsed flattened or absent. There are several causes of pes planus, including congenital, adult flexible, posterior tibial tendon dysfunction, tarsal coalition, peroneal spasticity, post traumatic arthritis, charcot foot or due to neuromuscular in-co-ordination.[7] This condition may be acquired due to various reasons including trauma, excessive use, impaired collagen synthesis, rheumatoid arthritis, neurologic disorders and neuromuscular disorders, pregnancy, types of shoes a child or adult wears, postural defects and obesity.[8] Adult pes planus may present as an incidental finding or as a symptomatic condition with clinical consequences ranging from mild limitations to severe disability and pain causing major life impediments. The adult pes planus is often a complex disorder with a diversity of symptoms and various degrees of deformity. Pathology and symptoms are caused by structural loading changes along the medial foot and plantar arch, as well as by collapse through the mid foot and impingement along the lateral column and rear foot. Muscles in the leg and foot tend to fatigue and cramp because of overuse.[9]

People with flat feet and the arched feet have a higher risk of foot pain, knee pain, foot injuries, fracture and poor exercise performance.[10] The various factors giving rise to the pes planus include age, sex, weight, race and some other anthropometric factors including height, and weight that make it one of the most serious and common problems in the 21st century.[11] Alternatively, because of limited data available in South Indian urban young adults, there is a necessity to investigate the cause and frequency of pes planus among young adults among the specified population.

MATERIALS AND METHODS

This cross-sectional study was carried out by the department of Anatomy of our tertiary teaching institution for a period of one year between April 2019 and March 2020. The study population included young adults aged 18-25 years who randomly visited the outpatient facility as patients and/or accompanying persons. Children <18 years and those with pre-existing neuromuscular problems, deformities or presence of open surgical wound or recent surgeries were excluded.

Based on intensive literature review, the prevalence of pes planus was reported to be 13.6%.[12] At 95% level of significance and 3.25% absolute precision, the estimated sample size was calculated as 425. Accounting 10% for refusals, the sample size was revised to 467 and rounded off to 500. The study subjects were selected by convenient sampling based on the selection criteria.

Approval was obtained from the Institutional Ethics Committee prior to the commencement of the study. Each subject was explained in detail about the study and informed consent was obtained prior to the commencement of the data collection. A structured proforma was used to obtain the demographic characteristics of the study subjects. Both the feet of the study subjects were first visually inspected. Footprint screening was carried out by applying printing India ink on the soles of both the feet of each subject and dynamic foot prints were obtained on A4 size sheet. On the basis of this test, pes planus and normal foot was noted. After the collection of the data, the adults who were diagnosed with the flatfoot were referred to the orthopedic surgeon for further evaluation.[13] Data was entered and analyzed using SPSS ver.20 software. The prevalence and demographic distribution of pes planus were expressed as percentages. Chi square test was to use compare the demographic data with pes planus incidence. A p value <0.05 was considered as statistically significant.

RESULTS

The basic anatomy of the foot and ankle is shown in Figure 1. A total of 500 adults aged 18 years to 25 years' normal healthy individuals had participated in the study. There were 168 (34%) males and 332 (66%) females as shown in the Table 1.

Table 2, Figures 2 and 3 (a,b,c,d) revealed prevalence of normal foot arch as 71% (355 out of 500) among participants, with a higher prevalence in females (240 out of 355, 68%) than in males (115 out of 355, 32%). Prevalence of pes planus was 29% (145 out of 500) among participants, with a higher prevalence in females (92 out of 145, 63%) than in males (53 out of 145, 37%). Pes planus analysis was done by foot print screening test as shown in the Figure 4.

Table 3 shows total prevalence of normal foot and pes planus in age wise distribution among adults. The highest prevalence and pattern of age wise distribution of pes planus observed in 20 years (24%), 18 years (16%), 19 & 21years (14%), 23 years (13%), and followed by 22, 24 & 25 years (10%,6%,3%) as depicted in Table 4 and Figure 5.

Table 1: Gender wise distribution of normal and flatfoot

Gender	No of participants	percentage
Male	168	34%
Female	332	66%
Total	500	100%

Table 2: Prevalence of normal and flatfoot among gender wise

Gender	Normal foot	% Normal foot	Pes planus	% Pes planus	Total
Male	115	32	53	37	168
Female	240	68	92	63	332
Total	355	71	145	29	500
Chi sq	0.79	P value	0.374		

Table 3: Prevalence of normal and flatfoot among age groups

Age	No of participants	Percentage
18	87	17%
19	73	15%
20	94	19%
21	68	14%
22	46	9%
23	57	11%
24	40	8%
25	35	7%
Total	500	100

Table 4: Prevalence of flatfoot in age wise distribution

Age	No of participants	Percentage
18	23	16
19	20	14
20	35	24
21	21	14
22	14	10
23	19	13
24	8	6
25	5	3
Total	145	100

In general, studies on the prevalence of pes planus in young adults, especially girls are limited, because of the low researches conducted in this field, it endured as a best motivation to study about it. Hence this study was performed on young healthy adults.

DISCUSSION

Pes planus is a pathological condition that commonly causes pain, limitations, and requires treatment. In this condition, a person does not have a curvature of the foot, either in a weight-bearing position.[14] The flatness differs from one study to another. Some researchers have shown

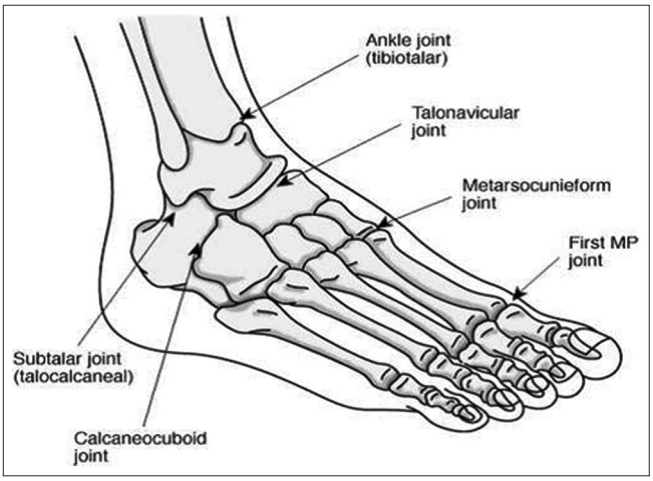

Figure 1: The anatomy of the foot and ankle (Picture courtesy of Allan McGavin sports medicine centre patient handouts)

Figure 2: Picture of normal foot of young adults

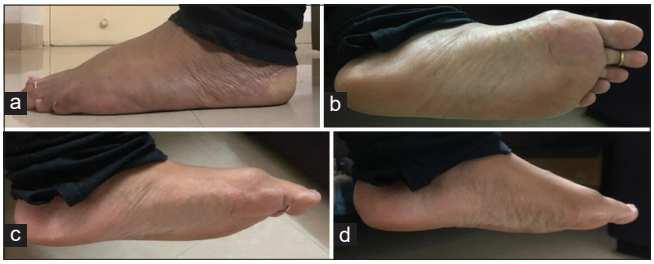

Figure 3: Pes planus of young adult in different positions(a,b,c,d)

Figure 4: Foot print analysis performed on A4 sheet

that the prevalence of pes planus increases with age. Some studies also refer to sex with the prevalence of pes planus.[15,16] Pes planus is a very commonly seen deformity

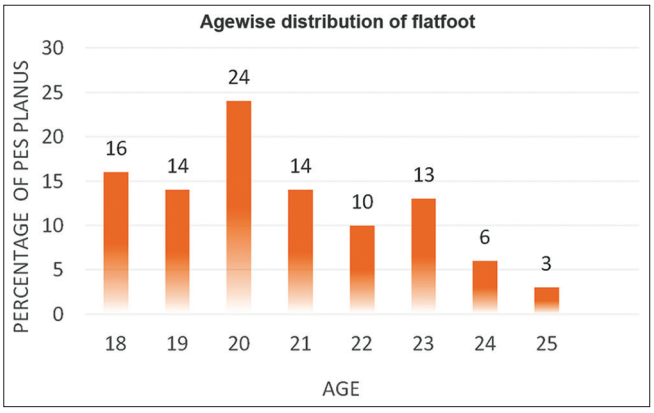

Figure 5: Showing prevalence of flatfoot in age wise

in children and adolescents, most of which are flexible. Most authors currently agreed that flexible flat foot may be considered an anatomic variant and is not a disabling deformity.[17]

History from participants revealed that Patients with pes planus showed poorer quality of life and foot function than patients not suffering from the disorder. This is similar to the study conducted by Pita-Fernandez et al.[18] In the current study, out of 500 subjects, the prevalence of pes planus was found in 145 subjects (29%). In a study done by Inamdar P et al, prevalence of 34.2% was observed, which is similar to the present study.[17] In this study, pes planus was predominant among females (66%) compared to males (34%). This result was similar to studies done by Okezu OC et al, Aenumulapalli A et al.[11]

However, the results were different in a study Vangara SV et al who found that males have a greater risk of pes planus than women with a prevalence of 42% in men and 36% in women. [19] Many authors found that men displayed significantly flatter feet than the women. However, in the present study, there was more prevalence of pes planus among female on both feet compared to male. Similar to this study, Aenumulapalli et al reported high incidence of pes planus in females than in males in age wise.[11]

CONCLUSION

The highest prevalence of pes planus was observed in 20 years. However, the prevalence of pes planus was higher in females. Study of pes planus in different populations will help orthopaedicians in evaluating the magnitude of burden of pes planus. Therefore, regular screening and monitoring would create awareness about foot problems and appropriate foot wear for persons with pes planus. Early screening is recommended for delaying the pes planus progression into the adulthood as it can help assist better in performing daily activities like walking, running and jumping without discomfort. "Detection of pes planus in young children may help in preventing foot abnormalities and hence reduce morbidity". Early detection may help the affected individual to use appropriate foot wear to perform routine activities better.

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Author's contribution
AR-Conceptualization and literature review; **HJ-** Data collection; **AM-**Data analysis and tabulation of results; **SG-**Manuscript drafting.

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