Journal of Health and Rehabilitation Research JHRR 2791-156X

For contributions to JHRR, contact at email: editor@jhrlmc.com

Original Article

Prevalence of Flatfoot in School-Going Children, Lahore

Adan Ateeque[1]*, Sidrah Shabbir[2], Taha Nadeem[1], Hira Zubair[1], Zainab Khizar[1]

[1]Akhtar Saeed Medical and Dental College Lahore Pakistan.

[2]Assistant Professor of the physiotherapy department, Akhtar Saeed Medical and Dental College Lahore Pakistan.

Corresponding Author: Adan Ateeque; Email: adanateeque19@gmail.com

Conflict of Interest: None.

Ateeque A., et al. (2024). 4(2): DOI: https://doi.org/10.61919/jhrr.v4i2.898

ABSTRACT

Background: Flatfoot is characterized by a reduced medial longitudinal arch height and can be flexible or fixed, congenital, or acquired. It can influence physical activity and mood in children, and its prevalence varies widely among different populations.

Objective: To determine the prevalence of flatfoot among school-going children aged 7-15 years in Lahore, Pakistan, and to assess its distribution across different age groups and genders.

Methods: A cross-sectional study was conducted over six months at Dar-e-Arqam School, Westwood campus, Lahore. The sample size of 106 was calculated using the formula { n = Z^2 P(1-P) / d^2 } with a 16% expected prevalence, 7% precision, and Z value of 1.96. Non-probability sampling was used. Inclusion criteria were children aged 7-15 years of both genders, excluding those with fractures, congenital deformities, or a history of ankle sprain. Footprints were obtained using ink-impregnated pads, and the Chippaux-Smirak index (CSI) was used to diagnose and grade flatfoot. Data were analyzed using SPSS version 25, with descriptive statistics presented as frequencies and percentages.

Results: The prevalence of flatfoot among the children was 40.6%, with 4 cases of unilateral flatfoot (3.8%) and 39 cases of bilateral flatfoot (36.7%). Normal arches were found in 62 children (58.5%), and 1 child (0.9%) had a high arch. Among those with flatfoot, 17 had grade 1 flatfoot (16.0%), 12 had grade 2 flatfoot (11.3%), and 14 had grade 3 flatfoot (13.2%). The highest prevalence of flatfoot was observed in the 7-9 years age group (23 cases), while the 13-15 years group had the highest number of normal arches (29 cases). There was no significant difference in the prevalence of flatfoot between genders.

Conclusion: Flatfoot is relatively common among children in Lahore, with a prevalence of 40.6%. The condition's prevalence decreases with age, and no significant gender differences were observed. Further research should include a larger sample size, random sampling, and assessment of symptomatic aspects to enhance understanding.

Keywords: flatfoot prevalence, pediatric flatfoot, Chippaux-Smirak index, foot arch assessment, Lahore children, school-aged children, foot orthoses, non-surgical interventions, cross-sectional study, SPSS analysis.

INTRODUCTION

A flat foot, or pes planus, is a deformity characterized by a reduced medial longitudinal arch height, typically 15-18 mm in healthy feet (1). In children, the presence of a fat pad on the plantar surface often results in a flexible flat foot, a condition that can persist for years and varies across populations due to various factors (2). Flatfoot can be categorized into flexible and fixed pes planus. Flexible pes planus can be either asymptomatic or symptomatic (3). Additionally, flatfoot can be classified based on occurrence as either acquired or congenital (4). It is important to note that individuals with flatfoot are more prone to experiencing lethargy and negative moods compared to those with typical arches, as suggested by various evaluations (5). Pediatric flexible flatfoot (PFF), which is mostly flexible flat foot, generally resolves after the first decade of life (6).

Treatment for flat feet includes both surgical and nonsurgical interventions. Nonsurgical options encompass stretching exercises, inversion muscle exercises (IME), manipulation, and the use of foot orthoses (7). Orthotic devices or customized shoes can correct pes planus, with foot orthoses notably improving physical functions like walking, though their efficacy in pain reduction or control remains uncertain (8). The use of rigid foot orthoses (RFOs) in the early stages of treating pediatric flexible flatfoot is beneficial for the development of normal arches, with long-lasting effects (9). Hallux valgus, a condition where the toes deviate from the foot's midline, can be exacerbated by hyperpronation or excessive inward rolling of the foot (10). Orthotic devices can mitigate injuries

Journal of Health and Rehabilitation Research 2791-156X JHRR

and enhance nerve stimulation in athletes with flat feet (11). The severity of flatfoot is assessed by evaluating muscle weakness and prescribing targeted exercises to enhance foot stability. Various methods for diagnosing pediatric flatfoot include tape measurements, advanced 3D scanning, and footprint analysis, with Clarke's angle, Chippaux-Smirak index, and Staheli arch index being reliable metrics for grading (12).

Footprint analysis is a diagnostic technique that involves examining a person's foot imprints and taking precise measurements of various dimensions. A mathematical formula is applied to derive a ratio, aiding in the categorization of the foot arch and diagnosing conditions like flatfoot by identifying deviations from the norm (13). The prevalence of flatfoot in children is influenced by several factors, including age, gender, BMI, demographics, shoe type, socioeconomic status, lifestyle, and daily activities (14). This study aims to evaluate the frequency of flatfoot in children in Pakistan, with the goal of promoting early diagnosis, cautionary measures, and the use of orthoses to facilitate pain-free daily activities such as walking.

MATERIAL AND METHODS

The study utilized a cross-sectional design over a six-month period at Dar-e-Arqam School, Westwood campus, Lahore. The sample size was determined to be 106 using the formula { n = Z^2 P(1-P) / d^2 } (15), where Z was 1.96, P (the expected prevalence based on previous studies) was 16% (16), and d (precision) was 7%. The non-probability sampling technique was employed. Inclusion criteria encompassed children aged 7-15 years of both genders. Exclusion criteria included children with fractures, congenital deformities, or a history of ankle sprain. The tools used were ink-impregnated pads, white sheets, ballpoints, and scales. Footprint analysis was the method adopted.

Permission was obtained from school authorities, and consent forms were signed by the guardians of the participating children. Footprints were collected using ink-impregnated pads; the soles of the feet were pressed onto the pads ensuring complete coverage with ink, and then the subjects were asked to stand and place their feet on white sheets to obtain the imprints. The Chippaux-Smirak index (CSI), defined as the percentage ratio of the central region width to the forefoot region width (B/A*100), was used for analysis. A CSI greater than 45% was identified as flatfoot, with further grading into three categories: 45-50% as grade 1 flatfoot, 50-60% as grade 2 flatfoot, and 60-100% as grade 3 flatfoot. This methodology was consistent with previous research by Alsancak et al. (2021) and Bogut et al. (2019) (1, 17).

Ethical approval for the study was obtained in accordance with the Declaration of Helsinki. Data collection was conducted in a manner ensuring the confidentiality and anonymity of the participants. The data were analyzed using SPSS version 25. Descriptive statistics were employed to summarize the data, with categorical variables such as age and gender presented as frequencies and percentages. Cross-tabulations and bar charts were used to illustrate the distribution of flatfoot prevalence among different age and gender groups.

RESULTS

The study included a total of 106 participants, divided into three age groups: 7-9 years, 10-12 years, and 13-15 years, with each group comprising 35, 35, and 36 children respectively, making up 33.0%, 33.0%, and 34.0% of the sample (Table 1). The prevalence of flatfoot was observed in 43 participants (40.6%), with a further breakdown revealing 4 cases of unilateral flatfoot (3.8%) and 39 cases of bilateral flatfoot (36.7%). In contrast, 62 children (58.5%) had a normal arch, while only 1 child (0.9%) had a high arch (Table 1). Among those diagnosed with flatfoot, 17 children (16.0%) were classified as having grade 1 flatfoot, 12 children (11.3%) had grade 2 flatfoot, and 14 children (13.2%) had grade 3 flatfoot (Table 1).

Table 1: Demographics of participants

Age groups	Frequency	Percentage
Group 1: 7-9 years	35	33.0
Group 2: 10-12 years	35	33.0
Group 3: 13-15 years	36	34.0
Total	106	100.0
Diagnosis	Frequency	Percentage
Flatfoot	43	40.6
Unilateral flatfoot	4	3.8
Bilateral flatfoot	39	36.7
Normal arch	62	58.5
High arch	1	0.9
Total	106	100.0

Journal of Health and Rehabilitation Research 2791-156X JHRR

Grades of flatfoot	Frequency	Percentage
Grade 1 flatfoot	17	16.0
Grade 2 flatfoot	12	11.3
Grade 3 flatfoot	14	13.2
Total	43	40.6

Table 2: Descriptive frequencies of flatfoot

Age group	flatfoot	Normal arch	High arch
Group 1: 7-9 years	23	11	1
Group 2: 10-12 years	13	22	0
Group 3: 13-15 years	7	29	0
Genders	flatfoot	Normal arch	High arch
Female	25	30	1
Male	18	32	0

Table 3: Cross-tabulation between age and grades of flatfoot:

	Grade 1 flatfoot	Grade 2 flatfoot	Grade 3 flatfoot
Males	8	5	5
Females	9	7	9
Total	17	12	14
Age 7-9 years	10	6	7
Age 10-12 years	5	3	5
Age 13-15 years	2	3	2
Total	17	12	14

Further analysis of flatfoot distribution by age group showed that in the 7-9 years group, 23 children had flatfoot, 11 had a normal arch, and 1 had a high arch. In the 10-12 years group, 13 children had flatfoot while 22 had a normal arch. For the 13-15 years group, 7 children had flatfoot and 29 had a normal arch, with no cases of high arch reported (Table 2). Gender-wise distribution indicated that among females, 25 had flatfoot, 30 had a normal arch, and 1 had a high arch, while among males, 18 had flatfoot and 32 had a normal arch (Table 2).

Cross-tabulation of age and grades of flatfoot revealed that among males, 8 had grade 1 flatfoot, 5 had grade 2 flatfoot, and 5 had grade 3 flatfoot. Among females, 9 had grade 1 flatfoot, 7 had grade 2 flatfoot, and 9 had grade 3 flatfoot. Age-wise, in the 7-9 years group, 10 had grade 1 flatfoot, 6 had grade 2 flatfoot, and 7 had grade 3 flatfoot. In the 10-12 years group, 5 had grade 1 flatfoot, 3 had grade 2 flatfoot, and 5 had grade 3 flatfoot. In the 13-15 years group, 2 had grade 1 flatfoot, 3 had grade 2 flatfoot, and 2 had grade 3 flatfoot (Table 3).

The first figure illustrates the distribution of flatfoot and normal arch among the three age groups, highlighting that the highest prevalence of flatfoot (23 cases) was in the 7-9 years group, while the 13-15 years group had the highest number of normal arches (29 cases). The second figure presents a more detailed breakdown of flatfoot grades within each age group. It shows that grade 1 flatfoot was most common in the 7-9 years group (10 cases), while grade 3 flatfoot was similarly prevalent in the same age group (7 cases). The 10-12 years group had a relatively balanced distribution across grades 1 and 3 flatfoot, with slightly fewer cases of grade 2 flatfoot.

These findings underscore the variation in flatfoot prevalence across different age groups and between genders, highlighting the importance of early diagnosis and potential intervention strategies for managing flatfoot in children. The detailed numerical values provided in the tables and figures offer a comprehensive overview of the study's demographic distribution and the prevalence and grading of flatfoot among the participants.

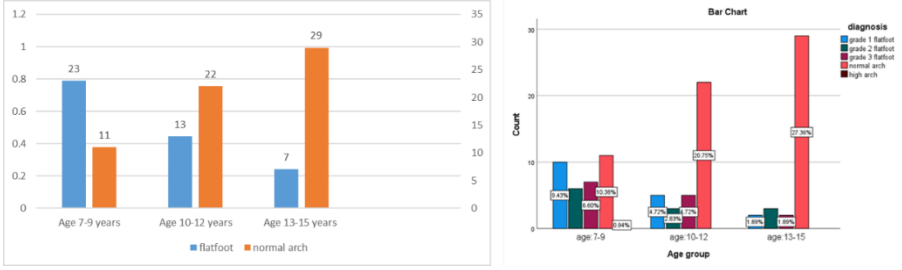

Figure 1 Age and Diagnosis Characteristics

Journal of Health and Rehabilitation Research JHRR 2791-156X

DISCUSSION

The objective of this study was to determine the prevalence of flatfoot in children aged 7-15 years. Data analysis revealed a prevalence of 40.6%, which contrasts with the findings of Sadeghi et al. (2018), who reported a 10.3% prevalence in a study of 667 children aged 7-14 years. Although the prevalence rates differ, both studies showed no significant difference in prevalence between genders (18). Similarly, a Pakistan-based study by Ibrahim et al. (2019) found a prevalence of 42% among children, again with no significant gender association. Despite the slight difference in age groups, both studies reported prevalence rates above 40%, reinforcing the findings of this study (19).

The study by Serap et al. (2021) on pediatric flatfoot and foot dimensions reported a 63% prevalence among 335 children aged 6-10 years, which is higher than the prevalence found in this study. Both studies, however, used similar methods and found no marked difference between genders (1). In contrast, a cross-sectional study conducted in Nigeria with 218 children reported a prevalence of 13%. This study used footprint scanning and analysis software, differing methodologically from the current study, but similarly found no significant gender differences (20).

Jichao et al. (2018) conducted a cross-sectional study on children aged 6-13 years, reporting a prevalence of 39% in the younger age group and 12% in the older age group. Both studies found that the prevalence of flatfoot decreased with age, although the prevalence in the current study was slightly higher at 46% for the younger age group (21). Yasin et al. (2023) investigated the prevalence of flatfoot among 1,256 children from five Middle Eastern and African countries, reporting a prevalence of 29.6%. This study differed in its use of a questionnaire-based approach to assess symptoms and diagnoses, while the current study did not focus on symptomatic assessment (22).

The strengths of this study include a well-defined sample size and the use of the Chippaux-Smirak index for footprint analysis, which is a validated method for diagnosing flatfoot. Additionally, obtaining consent and ethical approval ensured adherence to research standards. However, the study faced limitations, such as the non-probability sampling technique, which may limit the generalizability of the findings. The study also did not assess symptomatic manifestations of flatfoot, which could provide a more comprehensive understanding of its impact.

CONCLUSION

In conclusion, this study found that flatfoot is relatively common among children in Lahore, with a prevalence of 40.6%. The prevalence decreased with increasing age and showed no significant difference between genders. Future research should consider including a broader age range, employing random sampling techniques, and assessing symptomatic aspects of flatfoot to provide a more detailed understanding of its prevalence and impact on children's health.

REFERENCES

1. Alsancak S, Guner S, Güven E, Özgün AK, Akkaş Y, Alkıs N. Paediatric flat foot and foot dimension in Central Anatolia. BMC pediatrics. 2021;21(1):200.
2. Ueki Y, Sakuma E, Wada I. Pathology and management of flexible flat foot in children. Journal of orthopaedic science. 2019;24(1):9-13.
3. Kane K. Foot orthoses for pediatric flexible flatfoot: evidence and current practices among Canadian physical therapists. Pediatric Physical Therapy. 2015;27(1):53-9.
4. Michaudet C, Edenfield KM, Nicolette GW, Carek PJ. Foot and Ankle Conditions: Pes Planus. FP essentials. 2018;465:18-23.
5. Dabholkar T, Agarwal A. Quality of life in Adult Population with Flat feet. International Journal of Health Sciences and Research. 2020;10(2):193-200.
6. Evans AM, Rome K, Carroll M, Hawke F. Foot orthoses for treating paediatric flat feet. Cochrane Database of Systematic Reviews. 2022(1).
7. Turner C, Gardiner MD, Midgley A, Stefanis A. A guide to the management of paediatric pes planus. Australian journal of general practice. 2020;49(5):245-9.
8. Banwell HA, Mackintosh S, Thewlis D. Foot orthoses for adults with flexible pes planus: a systematic review. Journal of foot and ankle research. 2014;7(1):1-18.
9. Bok S-K, Kim B-O, Lim J-H, Ahn S-Y. Effects of custom-made rigid foot orthosis on pes planus in children over 6 years old. Annals of rehabilitation medicine. 2014;38(3):369-75.
10. Atbaşı Z, Erdem Y, Kose O, Demiralp B, Ilkbahar S, Tekin H. Relationship between hallux valgus and pes planus: real or fiction? The Journal of Foot and Ankle Surgery. 2020;59(3):513-7.

Journal of Health and Rehabilitation Research 2791-156X JHRR

11. Yalfani A, Ahmadi M, Asgarpoor A, Ahmadi AH. Effect of foot orthoses on dynamic balance in taekwondo athletes with flexible flatfoot: A randomized controlled trial. The Foot. 2023;56:102042.

12. Hegazy F, Aboelnasr E, Abuzaid M, Kim I-J, Salem Y. Comparing validity and diagnostic accuracy of Clarke's angle and foot posture index-6 to determine flexible flatfoot in adolescents: A cross-sectional investigation. Journal of Multidisciplinary Healthcare. 2021:2705-17.

13. Toyooka S, Shimazaki N, Yasui Y, Ando S, Saho Y, Nakagawa T, et al. Validity of a simple footprint assessment board for diagnosing the severity of flatfoot: a prospective cohort study. BMC Musculoskeletal Disorders. 2021;22(1):1-9.

14. Zhao X, Gu Y, Yu J, Ma Y, Zhou Z. The influence of gender, age, and body mass index on arch height and arch stiffness. The Journal of Foot and Ankle Surgery. 2020;59(2):298-302.

15. Naing L, Nordin RB, Abdul Rahman H, Naing YT. Sample size calculation for prevalence studies using Scalex and ScalaR calculators. BMC Medical Research Methodology. 2022;22(1):1-8.

16. Chibuzom CN, Egele CS, Ndukwu CU. The Prevalence of Flat Foot among School-aged Children in a Nigerian Population: Prevalence of Flat Foot among School-aged Children in a Nigerian. Tropical Journal of Medical Research. 2022;21(1):113-20.

17. Bogut I, Popović Ž, Tomac Z, Matijević V, Radmilović G. Prevalence of foot deformities in young schoolchildren in Slavonia. Acta Clinica Croatica. 2019;58(2.):288-94.

18. Sadeghi-Demneh E, Melvin JM, Mickle K. Prevalence of pathological flatfoot in school-age children. The foot. 2018;37:38-44.

19. Ibrahim S, Khan MS, Asif M, Hussain F. Prevalence of Flat Feet among School Children. Website: www ijpot com. 2019;13(3):214.

20. Ibeabuchi M, Obun C, Olabiyi O, Oluwabusola E, Adebayo A. Prevalence of flat foot among 6-15-year-old Nigerian school children resident in Lagos. J Anatom Sci. 2020;11(2):153-8.

21. Yin J, Zhao H, Zhuang G, Liang X, Hu X, Zhu Y, et al. Flexible flatfoot of 6–13-year-old children: A cross-sectional study. Journal of Orthopaedic Science. 2018;23(3):552-6.

22. Yasin MS, Al-Labadi GaM, Alshrouf MA, AlRaie BA, Ibrahim RA, AlRaie LA. Pediatric and Adolescent Flatfoot: A Questionnaire Based Middle East and North Africa Study. International Journal of General Medicine. 2023:2055-61.