Original Article

Prevalence of Flat Foot: Comparison between Male and Female Primary School Students

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Objectives: The aim of this study was to determine the prevalence of flat foot in a population of 7-12 year old students and to investigate the relationship between flat foot and age and sex.

Method: In this cross-sectional study, a total of 945 students (460 girls and 485 boys) were examined. The presence of flatfoot and the degree of its severity according to Tachdjian's system of grading for flatfoot was assessed.

Results: The data showed that the overall prevalence of flat foot was 74% out of which 23% were mild, 34% were moderate and 17% were severe. The prevalence of flat foot in girl and boy students were 75.2% and 72.6% respectively, but this difference was not significant. Moreover, no significant relationship was observed between the prevalence of flat foot and age.

Discussion: This study showed that flat foot is a common problem among primary school students and should be addressed by responsible organizations.

Keywords: foot, flat foot, prevalence, students

Introduction
Flat foot is a condition in which the longitudinal and/or medial arches of the foot collapse. The entire foot sole comes into complete or near-complete contact with the floor or ground surface during all weight bearing activities (1). Infants are born with flat feet, so the flat appearance of an infant's foot is normal, and the longitudinal arch develops naturally by about age five or six. This process occurs throughout growth and is not affected by the use of external arch support (2).

In children and adolescents flat foot is related to various factors such as hypokinesis, obesity or hereditary factors. It can be classified into flexible and nonflexible (rigid) types (3).

Flexible flatfoot in children almost never causes any problems. In general, these children are asymptomatic. If it persists into adolescence, it may become symptomatic and require treatment (2). Rigid flat foot has multiple etiologies and leads to significant pain and disability, often requiring treatment (4). Clinical symptoms vary in people with flat foot but pain and fatigue are common after prolonged standing and foot deformation (5). Flatfoot rarely causes disability, but it is a major concern for parents and is a common reason behind pediatric orthopedist consultations at the preschool stage. Parents should know the importance of flat foot at school-age and if any symptoms exist, they should visit an orthopedist (4).

Many research experts have tried to determine the prevalence of flat foot at different times and from different parts of the world. The prevalence of flat foot varies in different regions of the world. Also, it may vary in one society from time to time. Different studies show various prevalence of flat foot between males and females (10-11, 13). So the purpose of this study was to identify the prevalence of flat foot in primary school students in Tehran and to investigate the relationship between flat foot and age and sex.

Methods
This research was a cross sectional study. Nine hundred forty-five children (460 girls and 485 boys)

aged 7-12 from primary schools in different districts of Tehran were studied. The age range in each grade was as follows: 7 to 8 years in the first grade, 8 to 9 years in the second grade, 9 to 10 years in the third grade, 10 to 11 years in the fourth grade, and 11 to 12 years in the fifth grade. None of them had a history of specific medical or orthopedic problems.

Clinical diagnosis of flat foot was based on valgus position of the heel, position of navicular bone and the formation of the medial arch on weight bearing (Tachdjian's system of grading for flatfoot 1990). If the medial arch was visible the foot was considered normal. If the medial arch was slightly impressed, it was graded as mild flat foot. If the medial arch was not visible or navicular bone had moved medially

and was palpable, it was graded moderate flat foot, and severe flat foot meant that the medial border of the foot was convex (6). SPSS version 18 was used to analyze the data. Frequency was calculated and chi-square test and Pearson's correlation coefficient were used. The results are given in 99% confidence interval (CI). All tests for statistical significance were two tailed and performed at < 0.05.

Results

A total of 945 students participated in the study: 48.7% girls (n=460), and 51.3% boys (n=485). Students were divided into 5 groups according to their class grade table (1).

Table 1: Distribution According to Grade

Grade	Grade 1		Grade 2		Grade 3		Grade 4		Grade 5	
Gender	No	%	No	%	No	%	No	%	No	%
Male	102	59.3	108	55.4	121	55.5	85	43.6	69	42
Female	70	40.6	87	44.6	97	44.5	110	56.4	96	58
total	172		195		218		195		165	

According to the results, prevalence of flat foot in girls is slightly more than boys: 75.2% of girl students and 72.6% of boy students showed flat feet, but without any statistical difference (p-value=0.35)

table (3). Moreover, prevalence of flat foot in grade 2 was the most common (34%) Table (2 & 3).

Table 2: Prevalence of Flat Foot (FF) and Normal Arched Foot According to Grade

	Normal No (%)	Mild F.F No (%)	Moderate F.F No (%)	Severe F.F No (%)
Grade 1	44 (25.6)	38 (22.1)	70 (40.7)	20 (11.6)
Grade 2	53 (27.2)	44 (22.6)	61 (31.3)	37 (19)
Grade 3	54 (24.8)	48 (22)	81 (37.2)	35 (16.1)
Grade 4	52 (26.7)	59 (30.3)	54 (27.7)	30 (15.4)
Grade 5	44 (26.7)	39 (23.6)	51 (30.9)	31 (18.8)

Table 3: Prevalence of Flat Foot (FF) and Normal Arched Foot According to Sex

	Normal No (%)	Mild F.F No (%)	Moderate F.F No (%)	Severe F.F No (%)
Male	133 (14)	122 (12)	186 (20)	44 (5)
Female	114 (12)	106 (11)	131 (14)	109 (12)

But there was no significant difference between prevalence of flat foot and age and sex Table (4).

Table 4: Relationship between Prevalence of Flat Foot and Sex and Grade

	Sex (p-value)	Grade (p-value)
Flat foot	0.35	0.98

Discussion

In the present study, the prevalence percentage of flat foot among the total population was 74%. Many studies have been carried out to determine the prevalence of flat foot in different age groups and genders in different cities of Iran and other parts of the world. Harris and Beath (1948) reported a prevalence of 23% among Canadian soldiers (7). Igbigbi et al. (2005) reported a prevalence of 43% in Kenyans and 23% in Tanzanians (8). Yucesan et al. (1993) carried out a study in Turkey and explained that flat foot was the most prevalent congenital abnormality in Turkish school children (22.8%) (9). Alamy investigated the prevalence of flat foot among school children in Tehran, Iran, where the prevalence of flat foot was found to be 35.6% (10).

When compared with the results of the aforementioned studies, the current study's result show a high percentage prevalence of flat foot among school-aged students in Tehran. In general, studies show a high prevalence of flat foot in this region. These differences depend on different factors, such as anatomical, physiological, genetics, culture, shoes, obesity, and the groups studied (11).

Many studies have been carried out in different cities of Iran across the years, and there are different reports of flat foot prevalence, for example 3.66% in Yazd in 1999 (l2), 35.7% in Shiraz in 2005 (5), and 11.8% in Babol in 2007 (11). Studies carried out in Tehran in recent years have reported different results, for example: 35.6% among middle school boys in 1997 (10) and 11% among high school girls in 2006 (14). These results show that the prevalence of flat foot among primary school students in Tehran is higher than others in Iran. However, a comparison of the present study's result with those of Alamy (10) shows that the prevalence of flat foot is increasing among students in Tehran. This is a serious warning that warrants appropriate planning.

Considering the percentage prevalence for sexual dimorphism, the prevalence percentages of flat feet in a total population of 1132 students in Babol were 11.6% for males and 12.1% for females (11). Another result from Nigeria reported higher percentage prevalence among females than in males (13). In both researches mentioned above, females had higher percentage prevalence than males, which is in agreement with the result of the current study. The incidence of severe flat foot is higher in females too. One explanation for the higher incidence of flat foot in females could be the greater laxity of their joints (10).

In conclusion, flat footedness can be said to be one of the most prevalent foot abnormalities among students in Tehran with an incidence of 74% among the sample population. The statistics show that in recent years, the percentage incidence of flat foot is growing and needs proper planning especially in the field of education.

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