PREVALENCE AND RISK FACTORS RELATED TO FLAT FOOT AMONG OVERWEIGHT AND OBESE ADULTS

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Abstract: Flat foot is a common deformity in adults. It is characterized by medial rotation and plantar flexion of the talus, eversion of the calcaneus, collapsed medial arch and abduction of the fore foot.

Objective: To calculate the prevalence of flatfoot among the obese and overweight populations and assessment of its associated risk factors

Methodology: This cross-sectional study was conducted on 207 overweight and obese adults from Aziz Bhatti Shaheed teaching hospital Gujrat. The participants were selected by non-probability convenient sampling started in May 2022 till September 2022. Participants who had fractures or dislocation of lower limb recently, or any surgery were excluded from the research. The diagnosis of flatfoot was based on clinical observations and with the usage of Harris mat. Data were entered and analyzed through SPSS (version 24.00) at 95% confidence interval and p-value ≤ 0.05 was considered as significant value.

Results: There were 23.2% (48) males and 76.8% (159) females. There were 42.9% (6) male who had flatfoot and 57.1% (8) females who had flat foot. 50.7% participants were of obese and 49.3% were overweight. Association of gender (χ^2=8.919, p-value<0.03, odds ratio=4.794), diabetes (χ^2=3.78, p-value<0.05, odds ratio=3.019), Osteo-arthritis (χ^2=7.194, p-value<0.007, odds ratio=4.142), hard sole (χ^2=5.539, p-value<0.019, odds ratio=3.628) and Beighton score (χ^2=5.926, p-value<0.015, odds ratio=4.02) was found statistically significant. While body mass index Kg/m^2, hypertension, co-morbidity and white-collar occupation were not associated with flat foot.

Conclusion: The study concluded that current study revealed that the prevalence of obese and overweight people having flat feet foot was less as compared to other studies. Significant risk factors were gender, joint laxity, diabetes, osteoarthritis, and hard soles. There is no significant relationship between BMI, hypertension, co-morbidity and white-collar occupation with flat foot.

Keywords: *Flat foot, Body Mass Index, Harris Mat, Joint Laxity, Beighton's score*

INTRODUCTION

A flat foot is a condition when the bottoms of the feet contact the floor while standing, the typical medial longitudinal arch is absent. This can be something you're either brought into the world with or a condition obtained further down the road through injury. Pes planus is a postural deformation, characterized as a fractional or complete breakdown of the medial longitudinal arch of the foot, joined by the accompanying 3-dimensional foot disfigurements: hindfoot eversion, forefoot adduction and supination, and lateral subluxation of the navicular bone and impact point valgus distortion.[1]

There are many reasons for flat feet, reasons for FFF incorporate embellishment generalized ligamentous laxity, neurologic disorders (cerebral palsy and hypotonia), muscular abnormalities (muscular dystrophy), genetic syndromes (osteogenesis imperfecta, Down syndrome, and Marfan's syndrome), collagen disorders such as Ehlers–Danlos, and other biomechanical causes like lower leg equines and valgus disfigurements. Then again, most rigid flat feet are connected with basic pathology, including injury, iatrogenic, tarsal coalition, congenital vertical talus, and peroneal spastic flatfoot. Posterior tibial ligament dysfunction is the most ordinarily obtained flat foot in grown-ups. The four strategies to analyze this are, visual investigating the foot, actually looking at the anthropometric qualities, really looking at the footprint boundaries, and radiographic procedures.[2]

Due to the lack of precise clinical or radiological criteria for identifying flat foot, the true prevalence of the condition is unknown. Numerous researchers from all over the world have looked at the occurrence of flat feet. Children between the ages of two and six are found to have a higher prevalence (21 to 57%), which diminishes (13.4% to 27.6%) in primary school students. According to several experts, it ranges from 5 to 14% in the adult population.[3]

The feet appear to be flat in infants due to the presence of fat. The arches become prominent when the child starts walking and the foot starts bearing the weight. The arches of foot rapidly develop between two to six years and become structurally mature around 12-13 years. Prevalence of flat feet is higher in children due to ligament laxity and declines with age. Early shoe wearing in children impairs the development of longitudinal arches.[3]

Adults might get flat feet as well. Adult patients who have the condition often have a gradual start of vague pain in the medial foot and behind the medial malleolus along the course of the tibialis posterior tendon. These patients increasingly complain of function loss and changes in foot shape as the illness worsens. Rigidity, arthritic changes, and ankle valgus may also be seen in the later stages. [4]

BMI, or body mass index, is a measure of relative weight that is frequently used (Keys et al., 1972). Body weight divided by square of height is how the BMI is calculated. Underweight (BMI 18.50 kg/m2), normal weight (BMI 18.50–24.99 kg/m2), overweight (BMI 25–29.99 kg/m2), and obese (BMI 430 kg/m2) are the four categories used by the World Health Organization to classify BMI.[5]

Obesity is usually understood to be an excess of body mass and body adipose tissue distribution that could reduce comfort in the workplace and during leisure activities due to accidents including sprains, strains, and dislocations (Matter et al., 2007). Children who are obese have been demonstrated to have lower motor activity and poorer postural performance than children who are not obese (Matter et al., 2007A high prevalence of falls, poor health, and a reduced quality of life are also observed in obese older populations, according to Fjeldstad et al. (2008), who also asserted that the distribution of adipose tissue may be a significant contributing factor to balance impairment. In terms of postural sway, energy cost, attentional cost, motor reaction time, and muscle torque, increased obesity has been shown to affect postural control (Katch et al., 1988; Salsabili et al., 2011 It should be mentioned, however, that some scientists disagree with the notion that obesity and childhood flatfoot are related.[5]

The ability of the human foot to support weight is divided into three categories: (a) temporary, which refers to situations where a person's BMI and load-bearing capacity are temporarily increased due to carrying extra weight for a brief period; (b) short-term, which refers to situations where a person's BMI and load-bearing capacity are increased for a longer period of time, such as during pregnancy; and (c) long-term, which refers to situations where a person.[6]

Compared to the management choices available for children, conservative management options for adults with pathologic flatfoot are somewhat more restricted. Plaster casting, splints, muscle training, orthoses, and shoes can all be used successfully for children depending on their age and level of skeletal development. Adults with pathologic flatfeet may, however, use orthoses, braces, and shoe modifications with only occasionally helpful outcomes. Surgical surgery may be required for patients who do not respond to conservative therapy.[4]

This study aims to evaluate the association of flat feet among obese and overweight people and its associated risk factors.

METHODOLOGY

A cross-sectional study non-probability purposive sampling of 207 participants was conducted in district Gujrat in 4 months. Age group of 20 years and above who were obese and overweighted were included in this research. While participants with poliomyelitis, previous operation (three month after operation), fracture of hip, leg or foot and dislocation of the lower leg or foot were excluded.[7]

After being selected in accordance with the criteria, they were examined for flatfoot and related risk factors. The participant was assured that their data will be kept anonymous and private. The participants were required to sign a consent form. 28 They were advised and reassured that their decision to participate in the study was entirely their own. Pseudonyms were used during the research, and all information was kept secret. Data coding was utilized to ensure privacy and secrecy by preventing identifying data from including personal information.[8]

The patient provided informed consent and was informed of the study's objectives before the researchers performed an interview using a structured data collecting sheet. The data collected included age, gender, height, and weight (BMI was calculated). For BMI purposes, height and weight were measured without shoes. The second step involved a physical evaluation, which looked at joint

laxity and the medium longitudinal arch when standing and sitting. The joint laxity was assessed using the Beighton score (0.80 to 0.92)[9], a reliable and valid method. And lastly, using Harris mat, a pedograph was taken. Harris mat is a reliable (0.80) source of information.[10] The degree of the flatfoot was assessed using the Denis method[6]. (figure 1 and 2)

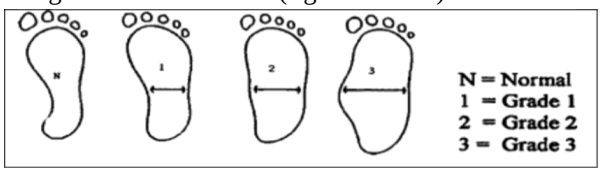

Figure 1: Denis method

Figure 2 normal foot and flat foot

RESULTS

Following results were obtained after analysis of data collected from 207 participants involved in the study aimed at finding association of flat foot and its prevalence in obese and overweight population in adults aged 20 and onwards. There were 23.2% (48) males and 76.8% (159) females. There were 42.9% (6) male who had flatfoot and 57.1% (8) females who had flat foot. 50.7% participants were of obese and 49.3% were overweight. There were 50% (7) participants who had flatfoot and were obese and there were 50% (7) who had flatfoot and were overweight. 35.7% (5) diabetic patient had flatfoot while 57.1% (8) patient of OA had flatfoot. There were 7.1% (1) patient who had hypertension and flatfoot. 64.3% (9) people wearing hard soled shoes had flatfoot. 42.9% (6) people with co-morbidity had flatfoot and 14.3% (2) people with white collar occupation had flatfoot while 71.4% (10) had joint laxity and flat foot.(Table 2) Mean(±S.D.) for gender was 38.4(±12.4) and for BMI was 31.0(±5.15).(Table 1)

Association of gender (χ^2=8.919, p-value<0.03, odds ratio=4.794), diabetes (χ^2=3.78, p-value<0.05, odds ratio=3.019), Osteo-arthritis (χ^2=7.194, p-value<0.007, odds ratio=4.142), hard sole (χ^2=5.539, p-value<0.019, odds ratio=3.628) and Beighton score (χ^2=5.926, p-value<0.015, odds ratio=4.02) was found statistically significant. While body mass index Kg/m^2, hypertension, co-morbidity and white collar occupation were not associated with flat foot.(Table 3)

Table 1.
Descriptive analysis of variables

Variables	n
Age in Years	38.4±12.4
BMI Score	31.0±5.15

Table 1 shows age of the participants was Mean ± Std. Deviation 38.4±12.4 and Mean ± Std. Deviation of BMI 31.0±5.15.

Table 2		
Risk Factors		n (%)
Gender	Male	48(23.2)
	Female	159(76.8)
BMI (Kg/m^2)	>29.9 (Obese)	105(50.7)
	25-29.9 (Over-weight)	102(49.3)
Diabetes	yes	35(16.9)
	no	172(83.1)
OA	yes	55(26.6)
	no	152(73.4)
Hypertension	yes	59(28.5)
	no	148(71.5)
Hard sole	yes	73(35.3)
	no	134(64.7)
Co-morbidity	yes	89(43)
	no	118(57)
White collar occupation	yes	25(12.1)
	no	182(87.9)
Beighton score	4-9 (hypermobile)	84(40.6)
	<4 non-hypermobile	123(59.4)
	Total	207(100)

Table 2 shows the different frequency and percentage of associated risk factors out of 207 participants.

Table.3 Association of flat foot of participants

Association	Flatfoot		Chi-square	P-value	Odds ratio	95% Confidence Interval	
	Yes	No				Lower	Upper

Gender	Male	8(57.1)	42(21.8)	8.919	0.03	4.794	1.576	14.580
	Female	6(42.9)	151(78.2)					
BMI (Kg/m^2)	>29.9 (Obese)	7(50)	98(50.8)	0.003	0.95	0.96	.328	2.860
	25-29.9 (Overweight)	7(50)	95(49.2)					
Diabetes	yes	5(35.7)	30(15.5)	3.78	0.05	3.019	.946	9.634
	no	9(64.3)	163(84.5)					
OA	yes	8(57.1)	47(24.4)	7.194	0.007	4.142	1.367	12.547
	no	6(42.9)	146(75.6)					
Hypertension	yes	1(7.1)	58(30.1)	3.362	0.067	0.179	.023	1.401
	no	13(92.9)	135(69.9)					
Hard sole	yes	9(64.3)	64(33.2)	5.539	0.019	3.628	1.168	11.271
	no	5(35.7)	129(66.8)					
co-morbidity	yes	6(42.9)	83(43)	0	0.991	0.993	0.33	2.974
	no	8(57.1)	110(57)					
White collar occupation	yes	2(14.3)	23(11.9)	0.069	0.793	1.232	0.26	5.856
	no	12(85.7)	170(88.1)					
Beighton score	4-9 (hypermobile)	10(71.4)	74(38.3)	5.926	0.015	4.02	1.217	13.285
	<4 non-hypermobile	4(28.6)	119(61.7)					
Total		14(100)	193(100)					

Table 3 shows that the gender (χ^2=8.919, p-value<0.03, odds ratio=4.794), diabetes (χ^2=3.78, p-value<0.05, odds ratio=3.019), Osteo-arthritis (χ^2=7.194, p-value<0.007, odds ratio=4.142), hard sole (χ^2=5.539, p-value<0.019, odds ratio=3.628) and Beighton score (χ^2=5.926, p-value<0.015, odds ratio=4.02) was found statistically significant. While body mass index Kg/m^2(χ^2=0.003, p-value<0.95, odds ratio=0.96), hypertension (χ^2=3.362, p-value<0.067, odds ratio=0.179), co-morbidity (χ^2=0.00, p-value<0.991, odds ratio=0.993) and white-collar occupation (χ^2=0.069, p-value<0.0793, odds ratio=1.232) were not associated with flat foot.

DISCUSSION

Pes planus is a frequent disease that affects adults. Adult flat foot is characterized by partial or total loss (collapse) of the MLA and is a foot ailment that continues or develops after skeletal maturity. Although adult flat feet are mostly asymptomatic, they can occasionally cause discomfort, functional impairment, and varying degrees of deformity. It may be inherited or acquired. Adult pes planus can be brought on by tarsal coalition, peroneal spastic flat feet, iatrogenic post-traumatic arthritis, Charcot foot, neuromuscular flat feet, and malfunction of the posterior tibial tendon.[11]

When compared to adults, children have a far lower occurrence of flat feet as their skeletons mature. The majority of earlier research on the frequency of flat feet was conducted on kids. With the aid of the Harris mat, this study sought to ascertain the prevalence of FF in the 20-year-old and older age group and to evaluate the relationship between that condition's risk variables.[3] The prevalence of flatfoot in overweight and obese population was 6.76%. which is the lowest in comparison to research on kids and a few studies on adults. In research on Indian adults between the ages of 18 and 21, the prevalence was 13.6%. While individuals in a Turkish study who were aged 6 to 18 had a flatfoot prevalence of 16.1%.[6]

A study was done in 2017 The purpose of this study was to identify the prevalence of flat feet among a randomly selected sample of people aged 40 and over, as well as how it affected their quality of life, reliance, foot discomfort, disability, and functional limitations. The conclusion was that age, Charlson's Comorbidity Index, BMI, and foot size were all related to flat foot. The results of the Barthel, Lawton, and SF-36 questionnaires were unaffected by the presence of flat feet. The FHSQ and FFI questionnaires did demonstrate a substantial sensitivity to the presence of flat foot. Charlson's Comorbidity Index indicated that flatfoot was common in

diabetic patients, and FSHQ contained data on hard soles that was consistent with our findings.[12]

This 2006 study examined the prevalence and risk factors for flat feet among male Saudi army recruits between the ages of 18 and 21. There were 2100 new military recruits, and 5.0% of them had flat feet. A case-control logistic regression analysis of the risk factors (104 cases and 412 controls) revealed that flat feet were significantly correlated with family history, wearing shoes as a child, obesity, and urban residence. Significant risk factors for flat feet were family history, the type of shoes worn throughout youth, obesity, and living in an urban area. This runs counter to our findings, which found that obesity was not a significant risk factor. [15]

This investigation was done in 2016. This study sought to examine the connection between obesity and flat-footedness. This cross-sectional descriptive study included a total of 1158 schoolchildren, 653 of whom were male and 505 of whom were female. Using the Dennis approach, the diagnosis and severity of flatfoot were determined. Body mass index (BMI) for kids was computed as height squared divided by weight. In this study, males were more likely than girls to have flat feet, but the difference was not statistically significant, which ran counter to our findings that gender was a key determinant.[6]

This study, which was carried out in 2010, revealed that a wide range of conditions may contribute to flatfoot deformity. The goal of this study was to pinpoint characteristics that can increase a person's risk of developing flatfoot deformity, which can in turn cause various foot and ankle disorders. In order to ascertain the relationships between several demographic characteristics and other foot and ankle diseases and self-reported flatfoot deformity, the 1990 National Health Interview Survey (Podiatry Supplement) was examined. The relationships between flatfoot and age, male gender, BMI, white-collar work, veteran status, bunion, hammertoe, calluses, arthritis, and poor health were found to be statistically significant. This study was in direct opposition to ours because there was no correlation between white-collar employment and BMI. [4]

Limitations: The outcome would have been better with an x-ray, but it was expensive.Since we lacked a pool and access to the data, we employed non-probability sampling.This study was conducted in Gujrat, it is a single center study. That's why we cannot generalized this result on other areas.

Recommendations. If at all possible, additional research could use x-ray to produce more precise results. Probability sampling should be done in the future for better selection. It is advised that additional research be done in other Pakistani cities.

CONCLUSION

The study concluded that current study revealed that the prevalence of obese and overweight people having flat feet foot was less as compared to other studies. Significant risk factors were gender, joint laxity, diabetes, osteoarthritis, and hard soles. There is no significant relation between BMI, hypertension, co-morbidity and white-collar occupation with flat foot.

Conflict of Interest

There was no conflict of interest.

Financial Statement

No fundings were given by any authorities; it was a project thesis of doctor of physical therapy.

Data availability

Data will be provided on the demand by corresponding author.

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Running Title: Prevalence and risk factors related to flat foot among overweight and obese adults.