The Association Between Flat Feet and Body Mass Index in Various Age Groups

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Abstract

Background/Objectives: The arches of the feet serve as an adaptive support for the entire body to drive away the forces of weight bearing and cause less energy consumption during the gait cycle. The arches of the feet are a tough, elastic network of ligaments, tendons and fascia between the forefoot and the hind foot. Though the flat feet are usually asymptomatic, but it can alter the biomechanics of the lower extremities and even the lower spine causing an increased risk of pain and injury. There are various studies who claim the association between obesity and flat feet in children's. To know the association of flatfeet and BMI in other age group,this study was carried out.

Methodology: Observational research with a cross sectional design was carried out at the physiotherapy OPD on 90 subjects which was selected by inclusion and exclusion criteria in the duration of 1 year. Group wise distribution was done by using purposive sampling. 3 groups were formed accounting their age.

Result: There is significant association between gender and Flat foot, where males in age groups 10-18 yr and 19-30 yr are more affected. BMI and flatfoot also showed significant association in above 2 age groups. When the analysis of variance (ANOVA) of average BMI was compared to the flat foot, there was a significant result in both same groups A. No significant results were found in chi square for association between age and Flatfeet.

Conclusion: Present study concludes that there is a association between BMI and Flat Feet in children's between 10-18 years of age and adults between 19-30 years of age.

Keywords: *Flat Feet, BMI, WHO, Obesity, ANOVA.*

Introduction

Flatfeet is a very regular term that is been used in daily routine. Flat feet" pes planus", it refers to the loss of the medial longitudinal arch of the foot where it contacts or nearly contacts the ground[1]. Though it is common problem in various age groups,negligence is often observed. Flat feet are always associated with heel pain, feet pain or even lower extremity pain. Altered biomechanics of arches of the feet often give rise to compromised functioning of lower extremities. These leading to altered posture and gait mechanism, the above all reason are sufficient enough to make difference in individual's quality of life.

In normal individual arches are been developed

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during the first five year of life span. If not develop, it can lead to flat feet which may be congenital or acquired[2].

Several studies have proven the association between the flat foot and obesity, and also obesity as a cause for the occurrence of flat feet. Increased weight of body places higher stress over the feet causing the arches to drop[3,4]. Obesity is seen as the first wave of defined cluster of non communicable diseases called NEW WORD SYNDROME, creating an enormous socio economic and public health burden in poorer countries[5,6]. Obesity is associated with other systemic problems like Diabetic, hypertension[4,7]. It is one of the listed cardiovascular risk factors[8], has significant effect on peripheral nerves[9] and microvasculature when associated with diabetes[4,10-12]. WHO has described Obesity as one of today's most neglected public health problem, affecting every region of the globe contributing to 1,12,000 deaths each year[13] occupational, a vocational & actions of daily living in adults involve adequate amount of time weight-bearing on our feet, such as while walking, running, roaming in public transport or standing at workplace. Flat arches may expose the affected individual to undue stress & faulty mechanism leads to pain & discomfort. Thus it is essential to their quality of life to and extent of their difficulty in functional activity. Presently specific to those individuals who travel or work on a daily basis, i.e., the age group of 19-30 years as they are more susceptible to occurrence of pain, limitation and social obstacle to foot problems. There is an growing need to endorse foot health amongst various age groups including adults, old age and childrens which is an issue that is common but frequently ignored as being inconsequential. Quantifying the impact of flat feet on quality of life in such individuals therefore makes it possible to identify the impact and plan preventive and rehabilitative strategies in these patients.

Who Classificatiuon of Weight Status	
Weightr Status	**BMI.KG/m**
Under Weight	<18.5
Normalrange	18.5-24.9
Over Weight	25.0-29.9.
Obese	>30
Obese Class 1	30.0-34.9
Obese Class 2	35.0-39.9
Obese Class 3	> 40

Previous studies in literature determined the prevalence of flat foot footedness among them, there is a study echarri and forriol 7 who reported 70% prevalence of flat foot in children 3-4 years of age and 40% between 5-8 years of age[14]. Foot problem appear in approximately 70%-80% of adults and 30% of children. The commonly appearing problem concern deformities of medial longitudinal arch, either because it excessively high or excessively low and have a significant impact on foot function and the development of musculoskeletal pathologies[15-21]. Even weakening of the calf muscle causes the drop of navicular bone resulting in flat foot.

Thus increased BMI causing increase incidence of flat feet in various ages will be targeted in a present study. Also, any gender different in will be monitored.

Objectives: The study was carried to find out Flat feet in obese individuals in various age groups. Again the study was targeted to observe any association between obesity and flat feet. Also any age and gender association with the flat feet were monitored.

Procedure of Study: The ethical clearance was obtained from the institutional ethical committee, to carry out the study. The institutional physiotherapy OPD was targeted to obtain the subjects for carrying out the study. The inclusion criteria was to get the willingly participating subjects between 10-45 years of age including both genders, whereas the subjects with recent lower extremities surgeries, recent trauma, any limb length discrepancy were excluded from the study. All the subjects included in study were then divided into 3 different groups according to their ages. The BMI was then calculated in all the 3 groups and Flat feet were seen by using DENIS method. The data was then collected and statistical analysis was done[1].

Results

In the present study 90 subjects were included according to the inclusion and exclusion criteria within the span of 6 months. In group A 53%male and 46% female between the age 10-18 yrs were analysed for their comparison of BMI with Flat feet, similarly Group B (19-30 yrs) and Group C (31-40yrs) were having 53% male,46% female and 43.33%male,56.67% female respectively. The study represents association of BMI with flat foot, using Chi square test showing p-value 0.015 significance in 10-18 years of age and 0.01 significance in 19-30 yrs of age. ANOVA test shows significant result on average BMI comparison to flatfoot in Group A and B.

Table 1: Association-BMI vs Flat Foot

Variable	Groups	Flat Foot			Chi Square	d.f.	p value	Significance
		Normal	FF1	FF2				
A BMI	Normal	3	3	0	15.83	6	0.015	Significant
	Overweight	5	5	0				
	Obese 1	4	6	2				
	Obese 2	0	0	2				
B BMI	Normal	4	6	0	16.99	6	0.01	Significant
	Overweight	1	10	1				
	Obese 1	1	1	3				
	Obese 2	1	0	2				
C BMI	Normal	3	3	2	1.52	4	0.82	Not Significant
	Overweight	7	7	1				
	Obese 1	3	3	1				
	Obese 2	0	0	0				

Table 2: ANOVA-Average BMI comparison according to Flat Foot

Variable	Groups	N	Average BMI	SD	F value	d.f.	p value	Significance
A Flat Foot	Normal	12	26.83	3.78	7.69	2,27	0.002	Significant
	FF1	14	28.21	3.44				
	FF2	4	34.75	2.75				
B Flat Foot	Normal	7	23.85	6.59	10.05	2,27	0.001	Significant
	FF1	17	25.52	2.62				
	FF2	6	32.83	2.78				
C Flat Foot	Normal	13	23.00	4.00	0.42	2,27	0.66	Not Significant
	FF1	13	27.46	4.53				
	FF2	4	27.50	5.06				

Discussion

In the present study we investigated flat foot among various age groups by using DENIS method which was carried out in cross sectional population, in that we have found correlation of flat feet with obesity and Gender in age between 10-40 years. The various factors give rise to the flat foot and the bottom of the foot, including the age, sex, weight, race and some other anthropometric factors that make it one of the most serious and common problems in the 21st century[15-16]. Meanwhile, Body Mass Index (BMI) is an indicator of functional and easily estimated relative weight and is largely linked to most direct obesity measures. The BMI depends to a large extent on the physical composition. BMI is a tool for evaluating healthy body weight. BMI is calculated by measuring the ratio of individual weight to height squared and is used to determine obesity and overweight. Several reports have shown that overweight and obesity may affect foot structure in children and adults[17-19]. Fattahi and Goodarzi (1395) showed that there is a significant relationship between BMI anthropometric index and flat foot posture[20]. A study conducted by Suciatiet. al in 2019 to find out the correlation between flat foot an BMI in primary school students of Indonesia, concluded significant relationship between both; with PR value of 2.36, indicating obese people have 2.36 times risk for flat foot compare to people who have normal BMI.

Shyamala Shree et.al in January 2018,conducted a

prevalence study to check whether the obesity can cause flat foot or not. They found a strong correlation between obesity and flat foot and no association of gender and age with flat foot also shows.[21] Our study also support the finding of the study conducted by Heba H. Hazaaa. al who found a significant correlation between obese children and flat foot when they performed a cross sectional study on 150 children between age 8 to 14 years.[22]

Adult flat foot may categorize as either residual flat foot deformity from a developmental cause or as an acquired flat foot. Acquired flat foot is associated with tight triceps' sure or isolated gastronomies tightness, posterior tibial tendon dysfunction, mid foot laxity, abduction of fore foot,external rotation of hind foot, subjugation of the talus, traumatic deformities, rupture planter fascia and neuro muscular imbalance[23].

Some persons with flat foot may never face any sort of problem while others may find it hard to engage in activities such as running or sports. Pain in the arch and heel area with or without swelling around the ankle, sometimes difficult to stand on some positions areall signs of symptoms of flatfoot. Getting shoes with arch and foot support is helpful in training the feet to develop an arch[24] arches give a functional support to the feet to stand on mare unstable surface and sturdy archmeans good support to your foot different joint in loer limb is work like a chain if one is in problem other cant work well. The analysis of data for 100 mtr sprint, 600 mtr run and 12 mi walk/run test revealed. That the normal foot performs better in 100 mtr sprint and 12 min run test but no difference was found for 600 mtr run test. 100 mtr sprints is an explosive activity which requires more forceful reaction from the ground and normal arched foot must be given help than a flat foot due to its springing action and strong muscles for the performance of 100 mtr sprint. Again 12 min run is a long distance run and weak foot might get fatigued in this run. Our findings correlate withy the authors (Cameron Thompson) who showed decrease in ankle muscle strength in flat foot. This might be the reason for hampered performance. Again 600 mtr run is neither explosive activity nor an endurance event, so the flat foot might had not fatigued and performed equally as normal foot[25].

We found that variability in plantar pressure does not follow the same U-shaped curve relationship with speed, as do other lower limb step kinematic parameters. The strength of long-range correlations for each gait pattern consistently follows U-shaped curves, centred on the subjects preferred speed.[26,27] Study by Chang-Ryeol Lee, Myung-Kwon Kim et al[26] said the sub talar joint excessively phonated, causing a rear foot valgus posture,in which the calcaneous is everted away from the midline. In this position, the fore foot is usually adducted, and talus and navicular bones a new depressed. Furthermore, although the anterior/posterior index,medial/lateral index,and overall satiability index increased after the exercises, the increases were not significant flat foot has been associated with increased planter peak forces,increased forefoot supination,and increased knee internal rotation.

Fatigue of intrinsic muscle did not affect the hip,knee and ankle strategy which would have had a direct impaction balance. Walking for a long time and impact on the foot reduce the ability of people with flatfoot to support the medial longitudinal arch, which increases the pressure on the middle fore foot area and mid foot medial area[4,27-29].

Conclusion

The present study concluded that there is significant association between Flat feet and obesity in Age group 10-18 yrs and 19-30 yr. Present study shows non-significant association between age and Flat feet and also no gender discrimination in the occurrence of Flat feet. Male obese individuals in age 10-30 yrs should be given more attention as they are more prone for the occurrence of flat feet. Recently one study at Navi Mumbai by Twinkle Dabholkar, Anushka Agarwal,et al which stated that the presence of flat feet in an individual in the age group 20-40 years impacts his/her quality of life in the form of foot pain, difficulty to do daily living tasks such as walking on uneven ground, walking fast, running and maintaining balance. Also, a high proportion of our participants reported having trouble in walking on uneven ground and running (79%). Continuous and proactive measures for screening and prevention of flat foot are recommended in this population.

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