Journal of Obesity & Therapeutics

Research Article

A SCITECHNOL JOURNAL

Does Obesity Cause Flat Foot?

Shyamala Shree[1]*, Revathi S[2], Arulmani Thiyagarajan[1] and Dhasarathi Kumar[1]

Abstract

Objective: Obesity is becoming hype in the field of Nutrition and health. The Study aimed to determine the effects of obesity on foot structure and function, and the foot pain experienced by college students.

Methods: Students from the department of health sciences and nursing were included in the study. The sampling was non-probabilistic and based on the willingness of the students to respond. Height and weight were measured on the student with light clothes and without shoes using standard apparatus. The Body Mass Index was used as an Indicator of obesity. Each subject was classified by their BMI score and scored accordingly.

Results: In this study, the overall prevalence of flat foot among obese subjects is 44%. The mean age of the participant was 20 years with S.D ± 3 and comparatively female students are high in number (62%). The variable weight and BMI are found to have significant statistical association (weight, p-value=0.00 and BMI, p-value=0.026).

Conclusion: This study aimed to check whether the obesity can cause flat foot or not. As per our results, there has been a strong correlation between overweight or obese and flat foot presence, which indicates that there exists association. And gender, age have no association with the Flat foot, supporting the previous literature.

Keywords

Obesity; Foot; BMI; Health

Introduction

The foot is a complex joint. It consists of 26 bones, and more than 30 articulations. It enables 3 fundamental functions which are support, shock absorption, and weight bearing. The foot places an important role in determining the biomechanical alignment of the body, especially in the lower limbs. Alteration in foot posture has been shown to affect the functions of the lower limbs.

Foot, as the body's base of support, continually endures high ground reaction forces generated during activities of daily living. The component primarily responsible for absorption and dissipation of the forces in the longitudinal arch [1].

Although this arch comprises bony articulations, ligaments, and muscles, it is primarily the ligaments that support and stabilize the longitudinal arch, as well as acting as powerful energy-storing mechanism [2].

***Corresponding author:** Shyamala Shree, School of Public Health, SRM University, Chennai, India, Tel: +919003253638; E-mail: shamu.sudha@gmail.com

Received: March 13, 2018 **Accepted:** March 20, 2018 **Published:** March 27, 2018

Flat foot is otherwise called as pes planus in which the longitudinal and or medial arches of the foot collapse [3]. The entire foot sole comes into complete or near-complete contact with the floor or ground surface during all weight-bearing activities [4]. 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.

Overweight and obesity occur due to the imbalance between intake and expenditure of energy. It can also result in excess adipose tissue which may encourage pathological storage of fat. Adult-onset overweight occurs with incorrect patterns of eating, sedentary lifestyle and other exogenous factors. Obesity and overweight during the developmental years are related to certain dimorphisms of the foot, in particular with the flat foot [5].

Deposition of body fat depends on numerous factors. Heredity and puberty play a major role in influencing the constitution of an individual. Boys have shown to be affected by the androgenic effects of puberty causing an increase in the central adiposity. Other factors such as smoking, alcohol intake, and stress or other environmental factors contribute to adolescent obesity. During puberty, there is the change in the rate and speed of bone growth and mineralization. In girls, there is a rapid increase in the bone mineral content, density and bone width within the first twelve months of attaining menarche. The growth of bones and the height become relatively slower

Increased loading of the feet may be classified according to time-frame and described as temporary, short-term or long-term [2]. A temporary loading effect occurs, for example, when carrying a backpack or wearing a weighted belt that temporarily increases body mass. In contrast, a long-term loading effect occurs over an extended period, such as in obesity, where the increase in mass is continuous. Although studies pertaining to temporary and short-term loading effects on lower limb and foot mechanics are available minimal research has examined the long-term loading effects of obesity on the musculoskeletal system, particularly in reference to the feet [2].

Various authors also have suggested that excessive increases in weight-bearing forces caused by obesity may negatively affect the lower limbs and feet. There are a number of mechanisms by which obesity may affect the foot. These include biomechanical changes to foot structure, such as pes planus, and changes to the plantar fat pad, including increased plantar pressures, inadequate muscular strength and/or power, particularly in activities requiring movement against gravity, and changes in gait.

Many factors influence the structure and functioning of the foot, one of them being body weight. The problem of overweight and obesity and their influence on foot arches has been to be dealt with, particularly in the context of an influence of excessive weight on flat foot incidence. Flatfoot is often a complex disorder, with diverse symptoms and varying degrees of deformity and disability [3].

Overweight and obesity have been shown to negatively affect foot structure and function in both children and adults. These structural changes appear to be associated with increased foot discomfort whereby overweight children have been found to report foot pain significantly more often than their leaner counterparts.

According to existing literature, it is identified that increased foot pain could act as a deterrent for obese individuals to participate in physical activity and in turn perpetuate the cycle of obesity, as a base of support during most weight-bearing activities is feet [6]. Because of this, compromised foot structure and foot pain associated with overweight and obesity which is deemed a major health issue for children. Despite the evidence, these negative effects associated with childhood obesity persist in the elderly foot has not been widely examined [7]. Therefore, the purpose of this study was to determine the effects of obesity on foot structure and function, and the foot pain experienced by college students.

Materials and Methods

Study setting

This study was conducted at the Department of Health Sciences of a private university in Chennai. The university is the largest private university in Chennai with three campuses in Chennai and many more branches all over India. The campus where this study was conducted has the Department of Health Sciences which supports undergraduate and postgraduate careers in Medicine, Dentistry, nursing, allied health sciences and Public health.

Sampling and sample size

Students from the department of health sciences and nursing were included in the study. The sampling was non-probabilistic and based on the willingness of the students to respond. However, it was ensured that a wide variety of students were included by approaching them in the hostels, classes, canteen and ensuring that both men and women were included.

Ethical consideration

The study was reviewed by an expedited review process and approved by the Institutional Review Board and Ethics Committee of the institution where this study originated. Written informed consent was obtained from all participants before administration of the questionnaires. The questionnaires were anonymized to ensure the protection of confidentiality. A pilot study was done to check the feasibility and time requirement of the study.

Body mass index

The height and weight of the subject were measured by stadiometer and weighing machine respectively, later they were used for the measuring Body Mass Index by the formula weight divided by height squared. The Body Mass Index was used as an Indicator of obesity. Each subject was classified by their BMI score and scored accordingly [8].

Foot structure assessment

Height and weight were measured on the student with light clothes and without shoes using standard apparatus. The Weighing machine was used to measure weight nearest 0.1 kg. Height was measured to the nearest 0.5 cm, using a measuring tape. To measure the height, the student was made to stand with heel, buttocks, shoulders, and occiput touching the wall. The head should be held erect with external auditory meatus and lower border of the orbit in a horizontal plane.

Each subject's BMI (Body Mass Index) was calculated using Standard Quetelet Index protocol: weight (kg)/ height^2 (m). The students were asked to wash their foot which will be properly dried after. Their foot was impregnated with the stamp ink and the impression was taken using the white paper with barefoot relaxed in the anatomical position.

All the students who were falling under inclusion criteria for the study were given a questionnaire containing the socio-demographic details and their foot measurements were taken and scored according to Denis method [9]. The interpretation of this method is by following scoring criteria. Normal – Lateral edge of the foot is supported by 4th and 5th metatarsal, Grade-1-Lateral edge of the foot is half of that the metatarsal support, Grade-2-support of the central zone and forefoot are equal and Grade-3-support of the central zone of the foot is greater than the width of the metatarsal support [10].

The plantar footprint was then classified according to Denis into three grades of flatfoot (Figure 1). Second or third-degree plantar footprint was considered as flatfooted. Subjects with first-degree plantar footprints have evolutionary foot problems without pathologic significance.

Results

In this study, the overall prevalence of flat foot among obese subjects is 44%. And according to the grade of flat foot, the prevalence of grade-1 flat foot among obese subjects is 12% and grade-2 and grade-3 among obese subjects is 32%.

The mean age of the participant was 20 years with S.D ± 3 and comparatively female students are high in number (62%). Most of the students were in the Pre-obese and Obese Class-1 range (75%) (Table 1).

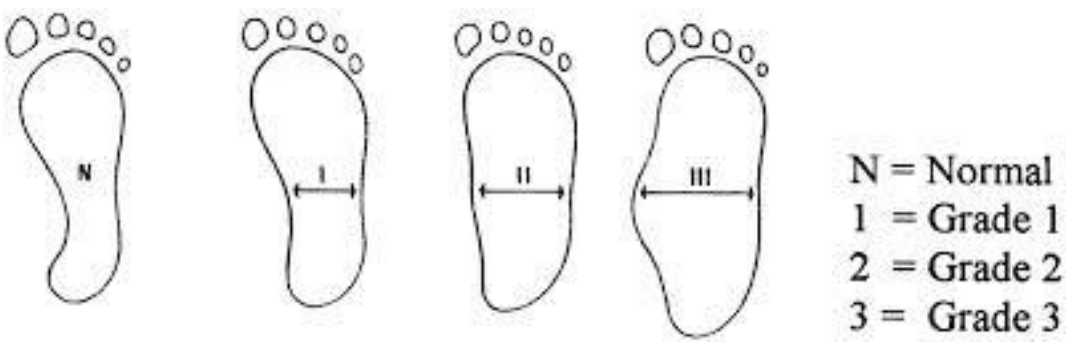

Figure 1: The plantar footprint.

Table 2 shows the results of Chi-square test, in which variable age, gender, height, weight, and BMI are analysed. It indicates the variable weight and BMI are found to have significant statistical association (weight, p-value=0.00 and BMI, p-value=0.026).

Table 3 signifies that there is a statistically significant Strong association between Grades of Flat foot and Weight (Pearson correlation value-0.73). Figures 2-4 shows our subjects foot prints for different grades.

Discussion

This study aimed to determine the effect of obesity on foot structure and function and the prevalence of flat foot among college students. By careful examination of footprints of subjects, the presence of flat foot determined in obese subjects is estimated to have 44% of overall prevalence. While comparing to other studies, our study showed high prevalence of 44% among obese subjects [11,12].

Previous studies suggested that there exists association between gender and flat foot [5,12,13], contrarily, our data prove that the age and gender do not have association with flat foot. The chi-squared test proves that there was the association between the weight, BMI, and flat foot. The lower plantar arch height in overweight and obese individuals put forward that the flat feet would be the characteristic of the overweight or obese individual which may be caused by the structural changes in their foot anatomy. The functional capacity of the medial longitudinal arch may be affected by these structural changes that occur in the individuals who are in the obese or overweight individuals which were seen during the changes from childhood to adulthood. From our data, it is proven that there has been an association with obese or overweight individuals with weight. By performing bivariate correlation, the strength of the association is measured by the weight and grades of the flat foot as measured by the Denis method. There has been strong association between weight and flat foot grade variable (Weight and Grades of flat foot, Pearson correlation value=0.73, p-value<0.001)

As per the existing reports, the weight of the individuals is directly proportional to the lower plantar arch height. Our data also suggest that obese or overweight individual have a strong relationship between

Table 1: The percentage distribution of age, gender, height and weight and BMI.

S. No.	Variables	Categories	Percentage
1	Age	17-20 Years	41.18%
		21-23 Years	39.22%
		24-26 Years	19.61%
2	Gender	Female	61.76%
		Male	38.24%
3	Height (in meter)	1.40-1.53	33.33%
		1.54-1.66	52.94%
		1.67-1.79	13.73%
4	Weight (in Kg)	50-75	42.16%
		76-100	52.94%
		101-125	4.90%
5	BMI	25-34	74.51%
		35-43	20.59%
		44-52	4.90%

Table 2: Results of Chi-square test.

S.No.	Variables		Scoring			p-value
			Grade-1	Grade-2	Grade-3	
1	Age	17-20	18	11	4	0.259
		21-23	8	11	0	
		24-26	7	3	1	
2	Gender	Male	12	14	3	0.268
		Female	21	11	2	
3	Height	1.40-1.53	16	12	4	0.626
		1.54-1.66	14	12	1	
		1.67-1.79	3	1	0	
4	Weight	50-75	16	10	1	0.00*
		76-100	17	13	1	
		101-125	0	2	3	
5	BMI	25-34	22	13	1	0.026*
		35-43	10	10	2	
		44-52	0	2	2	

Note: (*- p-value < 0.05 –Level of significance), Chi-square test.

Table 3: Association between Grades of Flat foot and Weight.

Variable	Pearson correlation value	p-value
Weight	0.73	0.00*
BMI	0.42	0.00*

Figure 2: Subject Footprints of Normal.

Figure 3: Subject Footprints of Grade 1.

Figure 4: Subject Footprints of Grade 2 and Grade 3.

the weight and flat foot grade. As the BMI increases, the grade level of the flat foot also increases.

Complications of flat foot may cause various problems like Achilles Tendonitis, arthritis in ankle or knee joint, plantar fasciitis, muscle cramps, etc.,

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 are all signs of symptoms of flatfoot. Getting shoes with arch and foot support is helpful in training the feet to develop an arch.

Shoes which are PCR based can provide them easy walking with comfort than with barefoot. New kind of balanced shoes is designed which act as lightweight as possible to decrease the soreness of the feet and ankles.

Conclusion

Thus study aimed to check whether the obesity can cause flat foot or not. As per our results, there has been strong correlation between overweight or obese and flat foot presence, which indicates that there exists association. The study needs to be replicated for different populations under different scenario and validated accordingly for better understanding of the relationship. As there has been increase in the number of children being diagnosed as obese, it is required to contribute to prove the hypothesis.

References

1. Dowling A, Steele J, Baur L (2001) Does obesity influence foot structure and plantar pressure patterns in prepubescent children? Int J Obes 25: 845.
2. Ganu SS (2013) Effect of obesity on arch index in young adults. Online J Health Allied Sci 11: 1.
3. Atik A, Ozyurek S (2014) Flexible flatfoot. North Clin Istanb 3: 57-64.
4. Rocky Mountain Therapy Services (2016) Congenital Flatfoot (Pes Planus) in Children.
5. Daneshmandi H, Rahnema N, Mehdizadeh R (2009) Relationship between obesity and flatfoot in high-school boys and girls. Int J Sports Sci Eng 3: 43-49.
6. Steele J, Mickle K, Munro B (2009) Fat flat frail feet: how does obesity affect the older foot. Fac Health Behav Sci 64: 262-267.
7. Steele J (2009) Fat flat frail feet: how does obesity affect the older foot.
8. Nuttall FQ (2015) Body mass index. Nutr Today 50: 117-28.
9. Belagavi, Chougala A, Phanse V, Khanna E (2015) Screening of body mass index and functional flatfoot in adult: an observational study. Int J Physiother Res 11: 1037-41.
10. García-Rodríguez A, Martín-Jiménez F, Carnero-Varo M, Gómez-Gracia E, Gómez-Aracena J, et al. (1999) Flexible flat feet in children: a real problem? Pediatrics 103: e84.
11. Bhoir MT, Anap DB, Diwate A (2014) Prevalence of flat foot among 18-25 years old physiotherapy students: cross sectional study. Indian J Basic Appl Med Res 3: 272-278.
12. Pourghasem M, Kamali N, Farsi M, Soltanpour N (2016) Prevalence of flatfoot among school students and its relationship with bmi. Acta Orthop Traumatol Turc 1: 554-557.
13. Heba H, Gehan H, El-Meniawy, Safaa E, Mohamed B (2015) Correlation between gender and age and flat foot in obese children. Trends Appl Sci Res 10: 207-215.

Author Affiliations Top

[1]*School of Public Health, SRM University, Chennai, India*

[2]*Grand World Elder Care, Coimbatore, Tamilnadu, India*