Tibialis Posterior Muscle Endurance among Physiotherapist with Flatfoot - An Observational Study

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ABSTRACT

Background: The flattening of the foot's medial arch is known as acquired flatfoot. It's one of the most common problems seen among adult health-care providers.

Objective: The purpose of this study is to determine the tibialis posterior muscle endurance among physiotherapist with flatfoot.

Methodology: The observational study included 60 physiotherapists who met the inclusion criteria. The single legged heel rise test and the foot posture index were used to evaluate each individual with flatfoot.

Result: Normal BMI participants had an average of 23.9333 repetitions in their dominant leg and 23 repetitions in their non dominant leg, overweight participants had an average of 15.2857 repetitions in their dominant leg and 14.1071 repetitions in their non dominant leg, and obese participants had an average of 7.11765 repetitions in their dominant leg and 6.17647 repetitions in their non dominant leg in a single legged heel rise test.

Conclusion: Participants with flatfoot and a BMI of Overweight, Obese had lower tibialis posterior muscle endurance than flatfoot people with a normal BMI, and the participants had higher tibialis posterior muscle endurance in their dominant leg than in their non dominant leg, according to the findings.

Keywords: Flatfoot, Body Mass Index, Tibialis Posterior, Foot posture Index, Single leg Heel Rise Test

INTRODUCTION:

Flatfoot is a multi-symptom disorder with varying degrees of deformity and dysfunction. [1]. It is one of the most common problems seen among adult health-care providers [2]. The foot's medial longitudinal arch (MLA) is more flat than the typical arch, and the entire sole of the foot makes near-complete or total contact with the ground [3]. Flat foot prevalence varies by age, demographic type, and the presence of comorbidities. The true frequency of pronated feet in adults is unknown, owing to a lack of agreement on stringent clinical or radiographic criteria for determining a pronated foot [4]. Flatfoot is thought to be caused by obesity, ageing, ligament laxity, and gender. Increased BMI and lower body height have been linked to flexible flatfoot [5]. Over-pronation causes the foot's medial longitudinal arch to collapse, creating increased strain in particular foot and leg muscles, especially the posterior tibialis [6].

The posterior tibial tendon is found in the deep posterior compartment of the leg and originates from the interosseous membrane [7]. It is primarily inserted in the navicular bone, and had its secondary insertions at the proximal sections of the metatarsals and other tarsal bones,

and its principal function at the ankle joint is inversion and plantar flexion of the foot [8]. The tibialis posterior muscle is the arch's primary dynamic stabilizer. By controlling arch collapse and eversion of the foot, this muscle operates eccentrically as a shock absorber [9]. The Tibialis posterior tendon is responsible for maintaining a medial longitudinal arch, inverting the foot, and keeping the hindfoot in place [10]. Acquired flatfoot is another name for posterior tibialis tendon dysfunction. This is due to the fact that it is the most prevalent variety of flatfoot that occurs in adults. When the posterior tibialis tendon is ruptured or irritated, it causes posterior tibialis tendon dysfunction (PTTD). As a result, the Tibialis posterior tendon may be unable to offer arch stability and support, resulting in flatfoot [10]. When examining adult feet, the Foot Posture Index is a proven approach for standing foot posture measurement. It is a simple and quick approach for determining foot position that is also quite reliable [11]. It's a clinical tool for determining if the foot is supinated, neutral, or pronated. The Foot Posture Index is made up of six validated, criterion-based observations of an individual's back foot and forefoot while standing in a relaxed stance. The foot posture index has been used to investigate biomechanical risk factors for neuropathic ulceration in diabetic patients, to identify foot type as a basis for screening subjects as inclusion and exclusion criteria in clinical research, and to investigate the relationship between types and risk factors for sports training and injuries [12].

The single-legged heel rise test is the most often used tool in clinical practise and research to assess the strength and endurance of the plantar flexors and invertors at the ankle joint. [13] For physicians working in a variety of contexts, the Heel Rise Test (HRT) is a useful tool. It's frequently utilized to evaluate the functional qualities of the foot's plantar flexors at the ankle joint [14]. The goal of the study was to determine tibialis posterior endurance in flatfoot physiotherapists.

METHODS:

Observational study was conducted in Saveetha College of Physiotherapy Thandalam, Chennai. The convenience sample approach was used in this investigation, which lasted two weeks. There are 60 participants of both male and female were taken in the study all of whom have a pronated foot and are between the ages of 20 to 40 years and we excluded individuals with recent lower limb fractures, ligament injury, Plantar fasciitis and any other neuromuscular disorder population. All participants who expressed an interest in participating in the study were taken and given an information sheet, and their informed consent was obtained. We separated the participants into three groups depending on their BMI normal, overweight, and obese. All of the individuals were subjected to a foot posture index and a single legged heel rise test. The participants were advised to stand in a relaxed standing stance for the Foot Posture Index assessment. The participants were told to remain still and look straight ahead, with their arms by their sides. The participants back foot and forefoot was rated by the examiner. The rear foot score includes talar head palpation, curves above and below the malleoli, and calcaneal inversion/eversion. The forefoot score considers talonavicular congruence, medial arch height,

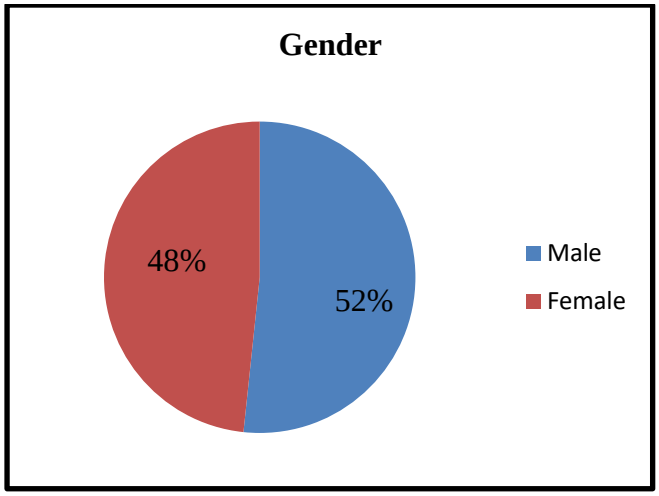
and forefoot abduction/adduction. The normal Foot Posture Index score ranges from 0 to 5, while the pronated foot score ranges from +6 to +9. To assess the single legged heel rise test, participants were asked to wear their regular sports or walking shoes. To aid balance, participants were permitted to place fingertip support on the wall in front of them at shoulder height. Each participant was told to complete as many single leg heel rises as they could, starting with one leg (right or left) and then the other, with the examiner counting and scoring the number of repetitions. The single legged heel rise test has a normal score of 25 repetitions. Individuals who are unable to do 25 repetitions of single leg heel rise are deemed to have a lack of tibialis posterior muscle endurance and are prone to have persistent heel discomfort and tibialis posterior dysfunction.

RESULT:

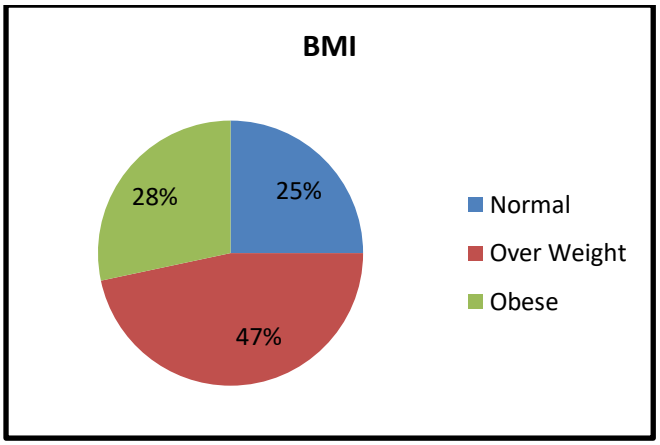
A total of 60 samples were collected, and we categorized them into three categories depending on their BMI: normal, overweight, and obese. Only 25% of the 60 samples fell into the normal BMI range. Overweight samples account for 46.7 percent of the total, whereas obese samples account for 28.3 percent. Each group of individuals had their Tibialis posterior endurance measurement separately. We acquired results of normal BMI, which meant that 25% of the samples (8 male and 7 female) had an average height of 166.13cm, a weight of 64.86kg, and a BMI of 23.46. Standing heel rises of average of 23.93 repetitions in the dominant leg and 23 repetitions in the non-dominant leg were performed by subjects with a normal BMI. The overweight participants (15 males and 13 females) had an average height of 162.64 cm, a weight of 73.32 kg, and a BMI of 27.57. They did a standing heel rise of average of 15.28 repetitions in their dominant leg and 14.10 repetitions in their non-dominant leg. Finally, there were 28.3 percent of participants who were obese (8 males and 9 females). They were average of 162.05 cm height and weight of 86.94 kg, and had a BMI of 33.10, and an average standing heel rise of 7.11 repetitions in their dominant leg and 6.17 in their non-dominant leg. As a result of this study, participants with flatfoot and a normal BMI had good tibialis posterior endurance, but overweight participants exhibited some tibialis posterior weakness when compared to participants with flatfoot and a normal BMI. When compared to persons with flatfoot who were overweight and had a normal BMI, obese patients exhibited inadequate tibialis posterior muscular endurance.

Table:

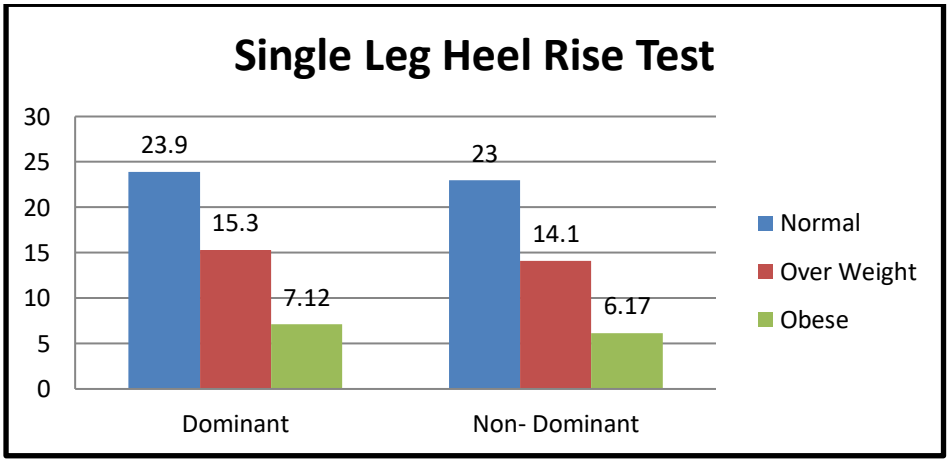
BMI	Population			Single Leg Heel Rise Test	
	Total No. Population	Male	Female	Dominant	Non-Dominant
Normal	15	8	7	23.9	23
Over Weight	28	15	13	15.3	14.1
Obese	17	8	9	7.12	6.17



Graph-1: Gender



Graph-2: BMI



Graph-2: Single Leg Heel Rise Test

DISCUSSION:

Today's physiotherapists consider flatfoot as one of the most common ailments. We discovered that it was caused by a decrease in tibialis posterior muscle endurance and a rise in BMI during the examination. The medial longitudinal arch appears to be supported dynamically by the tibialis posterior muscle, according to Robert A Kaye et al. A prior flatfoot deformity appears to be a risk factor for tibialis posterior tendon rupture, according to Cherisi M. Dyal et al. According to Kaye RA, Jahss MH, and colleagues, tibialis posterior insufficiency reduces inversion strength by at least half. Ruth L. Chimenti et al. found that aberrant forefoot and hind foot kinematics contribute to the difficulty of obtaining heel rise height in those with flat feet. The standing heel rise test, according to Brenda Rae Lunsford, should be utilised as the clinical method of choice for evaluating ankle plantar flexor function, with 25 standing heel rise repetitions serving as the benchmark for a grade of normal. Increased BMI is another factor that contributes to flatfoot. This is corroborated by a study conducted by Shyamala Shree et al., who conducted a prevalence survey among college students and determined that there was a high association between being overweight obese and having flat feet. There is a link between Tibialis posterior endurance and BMI for the prevalence of flatfoot, according to research. We recruited 60 people who have bilateral flatfoot for our investigation. We separated the participants into three groups depending on their BMI: normal, overweight, and obese. Out of the 60 people who took part, 25 percent had a normal BMI, 46.7 percent were overweight, and 28.3 percent were obese. Each group of subjects had their Tibialis posterior muscle endurance tested separately. We obtained the results of a Normal BMI population of 25% of participants, with 8 males and 7 females, with an average height of 166.13cm, a weight of 64.86kg, and a BMI of 23.46. Standing heel rises of 23.93 repetitions was performed in the dominant leg and 23 repetitions performed in the non-dominant leg by subjects with a normal BMI. And among 47% of overweight 15 male and 13 female participants, with an average height of 162.64cm and a weight of 73.32kg, as well as a BMI of 27.57, and they did a standing heel rise of average of 15.28 repetitions in their dominant leg and 14.10 in their non-dominant leg. Finally, there were 28.3% of obese participants among them 8 male and 9 female participants. They were 162.05 of average height, 86.94 kg of weight, and had a BMI of 33.10, with an average standing heel rise of 7.11 repetitions in their dominant leg and 6.17 in their non-dominant leg. As a result of this study, people with flatfoot and a normal BMI had good tibialis posterior endurance, but overweight participants had some reduced tibialis posterior endurance when compared to participants with flatfoot and a normal BMI. When compared to persons with flatfoot who were overweight and had a normal BMI, obese patients exhibited inadequate tibialis posterior muscular endurance. The study's observational nature and small sample size are its drawbacks. Future studies with a large sample size and such intervention may be recommended.

CONCLUSION:

Participants with flatfoot and a BMI of Overweight and Obese had poor tibialis posterior muscle endurance compared to flatfoot participants with a normal BMI, and the participants had

higher tibialis posterior muscle endurance in their dominant leg than in their non dominant leg, according to the findings. When compared to Flatfoot participants with normal BMI, those with Flatfoot and BMI of overweight or obese had a higher risk of medial heel pain and Tibialis posterior dysfunction.

CONFLICT OF INTEREST:

The authors declare no conflict of interest.

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REFERENCE:

1. Chougala A, Phanse V, Khanna E, Panda S. Screening of body mass index and functional flatfoot in adult: an observational study. Int J Physiother Res. 2015;3(3):1037-41.
2. Bhoir MT. Prevalence of flat foot among 18-25 years old physiotherapy students: cross sectional study. September 2014
3. Aenumulapalli A, Kulkarni MM, Gandotra AR. Prevalence of flexible flat foot in adults: a cross-sectional study. Journal of clinical and diagnostic research: JCDR. 2017 Jun;11(6):AC17.
4. Jayabandara A, Rodrigo D, Nadeeshan S, Wanniarachchi C, Rajathewa P, Makuloluwa T, Perera D. Prevalence of Flatfoot and Its Correlation with Age, Gender and BMI among Undergraduates at the Faculty of Allied Health Sciences, General Sir John Kotelawela Defence University. Journal of Pharmacy and Pharmacology. 2021;9:287-91.
5. Tenenbaum S, Hershkovich O, Gordon B, Bruck N, Thein R, Derazne E, Tzur D, Shamiss A, Afek A. Flexible pes planus in adolescents: body mass index, body height, and gender—an epidemiological study. Foot & ankle international. 2013 Jun;34(6):811-7.
6. Sánchez-Rodríguez R, Valle-Estévez S, Fraile-García PA, Martínez-Nova A, Gómez-Martín B, Escamilla-Martínez E. Modification of pronated foot posture after a program of therapeutic exercises. International Journal of Environmental Research and Public Health. 2020 Jan;17(22):8406.
7. Dyal CM, Feder J, Deland JT, Thompson FM. Pes planus in patients with posterior tibial tendon insufficiency: asymptomatic versus symptomatic foot. Foot & ankle international. 1997 Feb;18(2):85-8.
8. Smyth NA, Aiyer AA, Kaplan JR, Carmody CA, Kadakia AR. Adult-acquired flatfoot deformity. European journal of orthopaedic surgery & traumatology. 2017 May;27(4):433-9.
9. Van Boerum DH, Sangeorzan BJ. Biomechanics and pathophysiology of flat foot. Foot and ankle clinics. 2003 Sep 1;8(3):419-30.

10. Park S, Lee J, Cho HR, Kim K, Bang YS, Kim YU. The predictive role of the posterior tibial tendon cross-sectional area in early diagnosing posterior tibial tendon dysfunction. Medicine. 2020 Sep 4;99(36).
11. Lee JS, Kim KB, Jeong JO, Kwon NY, Jeong SM. Correlation of foot posture index with plantar pressure and radiographic measurements in pediatric flatfoot. Annals of rehabilitation medicine. 2015 Feb;39(1):10.
12. Redmond AC, Crane YZ, Menz HB. Normative values for the foot posture index. Journal of Foot and Ankle research. 2008 Dec;1(1):1-9.
13. Hébert-Losier K, Wessman C, Alricsson M, Svantesson U. Updated reliability and normative values for the standing heel-rise test in healthy adults. Physiotherapy. 2017 Dec 1;103(4):446-52.
14. Lunsford BR, Perry J. The standing heel-rise test for ankle plantar flexion: criterion for normal. Physical therapy. 1995 Aug 1;75(8):694-8.
15. Budiman-Mak E, Conrad KJ, Roach KE. The Foot Function Index: a measure of foot pain and disability. Journal of clinical epidemiology. 1991 Jan 1;44(6):561-70.
16. Kohls-Gatzoulis J, Woods B, Angel JC, Singh D. The prevalence of symptomatic posterior tibialis tendon dysfunction in women over the age of 40 in England. Foot and Ankle Surgery. 2009 Jun 1;15(2):75-81.
17. Alam F, Raza S, Moiz JA, Bhati P, Anwer S, Alghadir A. Effects of selective strengthening of tibialis posterior and stretching of iliopsoas on navicular drop, dynamic balance, and lower limb muscle activity in pronated feet: A randomized clinical trial. The Physician and Sportsmedicine. 2019 Jul 3;47(3):301-11.
18. Kim HY, Shin HS, Ko JH, Cha YH, Ahn JH, Hwang JY. Gait analysis of symptomatic flatfoot in children: an observational study. Clinics in orthopedic surgery. 2017 Sep 1;9(3):363-73.
19. Khanna N, Premavathy D. Assessing occurrence of flatfoot condition among student population. Drug Invention Today. 2019 Oct 1;11(10).
20. Dabholkar T, Agarwal A. Quality of Life in Adult Population with Flat Feet. Int. J. Health Sci. Res. 2020;10(8).