ORIGINAL ARTICLE

Effect of Body Mass Index and Ankle Dorsiflexion in Planter Fasciitis Patients; Performance Perspective

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ABSTRACT

Objective: To determine the effects of body mass index and ankle dorsiflexion in patients with plantar fasciitis.

Study Design: A cross-sectional.

Place and Duration of Study: The study was carried out at the Department of Physical Therapy of the two leading tertiary care centers, Advance Orthopedic & Reconstructive Institute & Dr. Ziauddin Hospital Karachi, Pakistan from August 2022 to June 2023.

Methods: Sixty-Four participants were recruited from the physical therapy departments of two tertiary care centers in Karachi by convenience sampling. The study focuses on the impact of demographics on the performance of plantar fasciitis patients. The measurement tools used in this are BMI (Body mass index), NRS (Numeric rating scale), LEFS (Lower extremity functional scale), and Goniometer. The data were analyzed by SPSS version 23.0.

Results: Our findings show that plantar fasciitis is more common in the obese-II category with reference to BMI, females are more affected than males with reference to gender, the middle age group is more affected with reference to age and dorsiflexion angle of patients is less than normal range shows the directly proportional of demographics with the performance of patients with plantar fasciitis.

Conclusion: Our study showed the positive effect of ankle dorsiflexion angle and BMI, gender, pain, and age on the physical performance of plantar fasciitis patients.

Keywords: *Disabilities, Functional Status, Quality of Life, Physical Activity, Range of Motion.*

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Introduction

Planter fascia is a fibrous band that starts from the calcaneal bone to the forefoot and its phalanges when the fascia becomes inflamed called plantar fasciitis. This band provides the largest stability to the longitudinal arch of the foot.[1] It affects mostly the age between 40-70 years the worldwide incidence of heel pain is about 10% and most females are affected with planter fasciitis as compared to males.[2] The prevalence rate may vary from every group of people in runners and obese persons the rate is high; up to 22% of runners may indicate planter fasciitis. The dorsiflexion of the ankle is limited, tightening of calf and foot muscles, standing for a long time, abnormalities in arches of the foot, and the most common body mass index higher than 27 kg/m^2 are the risk factors of plantar fasciitis.[3] Most of the

factors associated with gait patterns like muscular weakness, impaired balance, increased chances of falls, and also footwear.[4] Planter fascia acts as a shock absorber and also provides support to the arches of the foot. In plantar fasciitis, this fascia becomes inflamed due to overuse, uncomfortable shoes, continuous load exerted on the foot, and stress.[5]

Planter fasciitis can be diagnosed based on the symptoms present in the person like complaints of heel pain, and stiffness on the bony area of the calcaneus and patient also complain about the sharp pain exerted while taking the first step in the morning. When they start walking or performing their activities of daily living they feel better but complain of pain still present.[6] Pain is a warning sign of any disease or issue that occurs in the body. When the initiation of sports activity pain is aggravated but the people doing warm-up exercises then they feel comfortable and complete their tasks. In a resting position, pain is relieved because the ending of nerves is pressure free while they are standing, or working position it exerts pressure on nerve endings and the patient starts complaining of pain.[7] Planter fasciitis causes gait problems and steps variation, and eventually, the tibia and femur rotated internally, and the functions of the foot become altered.[8] These alterations hinder the quality of life of a healthy person due to fear, tension, structural deformity of the foot, and mental depression because they face many problems in their routine life.[9] Because the foot plays an important role in the movement, controlling a postural balance that's why it affects the normal activities of life. The ankle is a complex joint because it makes a connection between the lower limb and the ground to perform movement. Generally, the movement of the foot occurs in three planes; sagittal, coronal, and horizontal.[10] Planter fasciitis is a progressive degenerative condition that mainly occurs by minor injuries caused by the junction of bone and tendon of the calcaneal bone. It is increasing day by day in middle age female patients by prolonged standing, runners, a person with high arch issues, or flat foot deformity.[11]

Management of plantar fasciitis, about 90 percent of people can manage this by conservatively like rest, ice, wearing braces, heel cushions, night splints, arch support, shoes with well-supported arches, analgesics, steroidal injections, anti-inflammatory drugs, extracorporeal shock wave therapy, therapeutic ultrasound, and by some stretching exercises.[12] the treatment takes at least 6 months or 1 year. The most effective treatment in early diagnosis of PF is treatment with the combination of icing and ultrasound therapy because it reduces the planter inflammation and helps in healing.[13] Most of the patients can resolve this issue timely with taking a better treatment, attending multiple sessions of physical therapy, perform exercise at home. In treating the planter fasciitis, the best exercise is stretching. 83 percent of patients performing stretching exercises and feeling relieved from pain, 29 percent of people said that stretching is a very effective method as compared to using any other modalities. The techniques of stretching perform in the lower limb, mostly target the plantar fascia, gastrocnemius, and soleus muscle.[14] After 12 months it is not resolved by conservative management then they recommend surgery. Almost 5 percent of patients are not relieved by conservatively and go for surgery. The rate of successful surgery is quite high.[15]

Methods

Research Participants

This was a cross-sectional study that was designed to evaluate the risk factors of Plantar Fasciitis. In this study, a total number of 64 planter fasciitis (PF) patients were recruited through the raosoft software as research participants from the Physical Therapy Department of two tertiary care centers, Advance Orthopedic & Reconstructive Clinic and Institute & Dr. Ziauddin Hospital Karachi, Pakistan from August 2022 to June 2023. Ethical approval was received from competent authorities of Dr. Ziauddin University Karachi, Pakistan with reference no: BASAR/No.041560/physio date 8th August 2022. Patients of (PF) were eligible according to the following inclusion criteria of our study: pain in the region of plantar fascia and heel while they take 1st step in the morning, reported pain during the day time in the bearing of weight, patients who had no restrictions for the performance of ankle exercises from their medical doctor were included in our study.[16] While patients with diagnosed stress fractures of the foot, heel pain bilaterally, any

comorbid disease or illness, patients who smoke, and any musculoskeletal or pathological disorders that may affect the function of lower limbs were excluded from this study.[17]

Procedures

Each participant in the research was required to agree to participate in our study. They reported their weight and height in order to measure their BMI (Body Mass Index). They are also required to fill out the LEFS (Lower Extremity Functional Scale) questionnaire. It comprises 20 items each item rating from 0 to 4 in which questions related to physical functional status and lower limb injuries occur during the activities of daily living. Participants who scored 80 meant their functional status is good but participants who gain 0 scores meant they had severe disability.[18] Furthermore, the NRS (Numeric Rating Scale) comprises 0 (no pain) to 10 (worse pain) ratings through which patients can report their level of pain in their aspects.[19] The ankle dorsiflexion Range of motion which is done by the Talocrural joint was tested through a Goniometer which is a device used to measure the joint range of motion of a subject.[20] For measurement of ROM examination, the patient was asked to lie on the couch in a prone position with the leg extended and the ankle off from the couch, and the Physical therapist will stabilize Tibia to avoid tricky movement. Now therapist placed the axis of the goniometer on the lateral calcaneus of the fibula and 5th metatarsal joint, a stationary arm of the goniometer was parallel to the fibula and the moveable arm of the goniometer was parallel to the 5th metatarsal bone of the foot.[21] In this manner, the ankle dorsiflexion was measured and the physical researcher observed and notes the readings of the goniometer. During the measurement of ROM, the researcher used the same goniometer to avoid potential errors.

Statistical Analysis

This was done through SPSS version 23.0. To determine the correlation between the different demographic variables and the physical and functional status of participants. All categorical data were given in frequency and percentages.

Result

A total number of 64 planter fasciitis patients was evaluated through a validated questionnaire, NRS, BMI, and ankle dorsiflexion measurement. Among our research participants who are diagnosed patients of plantar fasciitis 23 (35.93%) lie in the category of obese II according to the Asian classification of BMI. We measured the ankle

Table 1: Characteristics of Planter Fasciitis patients

Variable	Frequency (n)	Percentage (%)
Gender		
Male	28	43.75
Female	36	56.25
Age		
20-35	16	25
36-50	31	48.43
51-65	10	15.62
>65	7	10.93
Body Mass Index (kg/m2)		
<18.5	7	10.93
18.5-22.9	9	14.06
23.0-24.9	11	17.18
25.0-29.9	14	21.87
≥30	23	35.93
Dorsiflexion of Ankle (Involved side)		
>10°	11	17.18
6°-10°	7	10.93
1°-5°	27	42.18
0°or less	19	29.68

dorsiflexion of the involved side was more in between 1°-5° among 27 (42.18%) participants as shown in Table 1. The highest value of pain is found in a moderate level of NRS (Numeric Rating Scale) between the ages of 36-50 years as shown in Table 2. The frequencies and percentages of Participants

Table 2: Numeric Rating Scale of Planter Fasciitis patients

Numeric Pain Rating Scale (0-10)	Frequencies
None	5
Mild	19
Moderate	27
Severe	13

responded with a little bit of difficulty in 21 (32.81%) who performed light activities and 21 (32.81%) participants answered in the moderate difficulty group concerning heavy activities performance with a significant *P*-value <0.001.Twenty one (32.81%) participants faced extreme difficulty in standing for 1 hour, 12 (18.75%) participants had quite a bit of difficulty, 11 (17.18%) had moderate, 14 (21.87%) had mild, and 6 (9.37%) had no difficulty in 1-hour standing duration while 17 (26.56%) participants responded extreme difficulty in sitting for 1 hour, 14 (21.87%) responded quite a bit difficulty, 12 (18.75%) had moderate difficulty, 7 (10.93%) had mild, and 14 (21.87%) had no difficulty in sitting duration with the significant *P*-value <0.001 as shown in figure no.1.

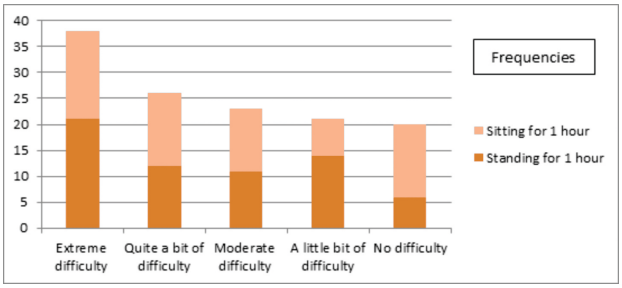

Fig 1: Association of sitting and standing in Planter Fasciitis patients

Discussion

The inflammation of the plantar fascia due to overuse, uncomfortable shoes, and prolonged standing is known as plantar fasciitis.[22] In our study, we are considering the role of different demographic characteristics like age, body mass index, and range of dorsiflexion on the performance of patients with plantar fasciitis. According to the study, the association of age with the quality of life of plantar fasciitis is significant, they concluded that with the increase in age of patients, their quality of life is unaffected.[23] As compared to our research age showed an insignificant effect on the quality of life of a person, middle age population from 36 to 50 years is 48.43% is mainly shown to be the warriors of plantar fasciitis as compared to the other age groups. This data can show that the quality of life is more affected in individuals of middle age. A study reported as they had not shown any correlation between gender and the physical status of patients with plantar fasciitis because they had the study population of both genders with different ages and lateral angles of 1st metatarsal joint and hallux valgus.[24] However, in our study, plantar fasciitis is more common in females with 56.25% as compared to the male population.

As body mass index is the measurement of body mass and height of an individual and it is denoted by kg/m^2.[25] The study showed BMI is the most important variable which affects the physical performance of plantar fasciitis patients and proved to be the main cause of disability[26] but in our study, the research participants with a high BMI of 35.93% lie in the obese-II category which showed a strong need of lifestyle modification and exercise which can reduce the weight of them and results in improved symptoms of plantar fasciitis as well. As ankle dorsiflexion is the foot movement toward the shin bone and the normal range of dorsiflexion is 20 degrees.[27] So, the study reported as the dorsiflexion angle is inversely proportional to the performance of plantar fasciitis patients because as the angle of dorsiflexion is shown to be less the presence of disability is more. In our study the ankle dorsiflexion angle is proved to be less than normal ranges i.e. 1 to 5 degrees in 42.18% of research participants which shows that below ranges affect the foot activity of plantar fasciitis patients which ultimately affects the physical performance of plantar fasciitis patients.

Furthermore, pain also has an important correlation with disability in health professionals who are already injured with plantar fasciitis and they have to continue their work to compensate for the balance between health and work. So, reliving from pain is a crucial component of one's life A study related to pain showed the young people mostly affected with the heel pain because the continuously stress on the fascia of planter causes the inflammation and also tighten the gastrocnemius muscle. Mostly patient's complaint about the pain in planter area when they take first step in morning. This point confirms the diagnosis that patient suffered from the planter fasciitis.[28] In our study patients with PF mostly fall in the moderate rating of 42.18% which shows that the association of pain with disability in patients is highly observed and that can limit the routine activities of patients. There are some limitations of our study as well like a large sample size can provide better results to show the impact of demographics with plantar fasciitis. We only examined the physical type of disability although a person can have the impact of social, and psychological that can cause the disability in a person with plantar fasciitis as well. For these reasons, researchers have the chance to research these aspects.

Conclusion

From our study, it is concluded that there is a significant relationship between BMI (Body Mass Index) and Pain with plantar fasciitis because as weight gain and pain increase the symptoms of P.F (Planter Fasciitis) can severely affect the patients and can cause disability. So, we concluded that age, gender, and dorsiflexion do not directly affect the person with plantar fasciitis and do not cause disability specifically related to these demographic features.

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Authors Contribution

PL: Idea conception, data collection, manuscript writing and proof reading
SH: Idea conception, study designing, data collection
VK: Idea conception, data collection
MFH: Data collection, data analysis, results and interpretation, manuscript writing and proof reading
SB: Data analysis, results and interpretation, manuscript writing and proof reading
KS: Data collection, manuscript writing and proof reading
KJ: Data analysis, results and interpretation, manuscript writing and proof reading

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