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Prevalence of Plantar Fasciitis and Its Association with Body Mass Index Among Taekwondo Players

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DECLARATIONS

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ABSTRACT

Background: Plantar fasciitis is a common musculoskeletal condition and a leading cause of heel pain in adults, affecting over one million individuals annually. Although self-limiting in nature, it often interferes with daily activities and athletic performance. It affects both sedentary and active populations, with risk factors including obesity, prolonged standing, running, and foot pronation. **Objective:** To determine the prevalence of plantar fasciitis and its association with body mass index in Taekwondo players. **Methodology:** A cross-sectional survey was conducted among 314 registered Taekwondo players aged 12–50 years, selected using convenience sampling. Participants were recruited from registered clubs affiliated with the Pakistan Taekwondo Association, covering all provinces and the federal capital. Data was collected using a structured Google Docs questionnaire in collaboration with the Secretary General of the Pakistan Taekwondo Federation, which included demographic details, informed consent, and self-reported height and weight to calculate BMI. The Windlass test was used as the primary clinical assessment for plantar fasciitis. Data was analyzed using IBM SPSS version 25, and the frequency and percentages were calculated. The association between plantar fasciitis and body mass index category was evaluated using the Chi-square test ($p<0.05$ considered significant). **Results:** Out of 314 participants, 72 (22.9%) tested positive for plantar fasciitis using the Windlass test. Heel pain was most prevalent in the 16–25 age group (14.6%) and among those with a normal body mass index (21%). However, statistical analysis revealed no significant association between heel pain and either age group ($\chi^2=3.12$, $p=0.53$) or body mass index category ($\chi^2=6.50$, $p=0.36$). **Conclusion:** It concluded a notable prevalence of plantar fasciitis among Taekwondo players in Pakistan, especially in younger individuals and those with normal body mass index. However, no significant associations were found between heel pain and age or body mass index. Further research is needed to explore other contributing factors such as biomechanics, training load, and footwear.

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INTRODUCTION

One of the most common problems experienced by one out of ten people in their lifetime is plantar fasciitis. Plantar Fasciitis is the irritation of the ligamentous band present at the plantar surface of the foot, which also acts as a supporting structure for the foot arches.[1] According to the current literature, the term plantarfasciosis or faciopathy is more relevant because of its chronicity and degenerative evidence rather than inflammation.[2] More than one million people are affected by plantar fasciitis every year worldwide.[3,4] It is increasingly recognized not only among professionals such as healthcare workers, teachers, factory workers, and military personnel, where prolonged standing, repetitive strain, and poor footwear contribute to its development, but also common in athletic populations.[5]

Symptomatic presentation of plantar fasciitis is heel pain with the first step after waking up in the morning or sitting for a prolonged period of time. With palpation of the medial plantar calcaneal region, sharp pain may be sensed by the patient. The commonly associated risk factors with plantar fasciitis are foot activities with excessive pronation, Obesity, prolonged running, and excessive standing or athletic activities involving the foot.[6] One of the famous etiological factors for plantar fasciitis is repetitive strenuous activity-related injury to foot plantar ligament. The most commonly affected population with plantar fasciitis is athletes and sedentary lifestyle.

Taekwondo (TKD) is a worldwide famous martial arts sport, traditionally originating from the Asian country of Korea. It is practiced in around 206 countries with highly profiled Physical and educational values.[7] In the Korean word taekwondo, "Tae" signifies "to kick"; "Kwon" suggests "punching" and "Do" signifies "strategy." Thus, taekwondo is a martial art of Self-protection that includes the skillful use of strategies such as Kicks, punches, jumping, blocks, and activities with hands and feet. Taekwondo players require very rapid directional changes while maintaining body balance, endurance, strength, and control over the body, most importantly of all, strengthened lower limbs, and performance improved with agility and practice.[8]

As a sport with a huge amount of physical involvement, especially in the lower extremity, it gives both physical and mental well-being. But the lower extremities are majorly prone to localized injuries in this sport, especially the foot, and these include ligamentous sprain, muscle strains, bruises, and contusions.[3] Research shows that in both genders, the most commonly injured body region in taekwondo is the lower extremity. The ratio of injured sites in taekwondo with respect to research shows that in the lower extremity, the knee (21.3%) has the highest incidence of injuries, followed by the foot (17%), the second most injured region, and then the ankle (12.2%), thigh (11.4%), and lower leg (8.8%).[3] In other research, it was observed that 54 percent of TKD injuries happened during competitions, whereas 36% happened during training.

Lower extremity injuries are more common (46%) than upper extremity injuries (18%). The remaining injuries were in the back (10%) and the head (3.6%).[9] Taekwondo martial art is mostly practiced barefoot (light shoes may be worn occasionally). Barefoot activities basically thicken the plantar skin, providing protection and reducing injury chances, along with increasing the plantar fasciitis.[10] So, as the foot is exposed to a large number of injuries, plantar fasciitis can be one of them. Repeated short, quick steps, kicks, and jumping, which are part of the taekwondo regime, can cause plantar fasciitis, Achilles tendinitis, and knee and leg tendinitis.[11] While perfecting most of the kicks and stances, the foot sole may go under repetitive strain, leading to plantar fasciitis. Therefore, the purpose of conducting this study is to find out the prevalence of plantar fasciitis in the athletes of the martial art taekwondo.

METHODOLOGY

This cross-sectional survey was conducted to assess the prevalence of plantar fasciitis and its association with body mass index (BMI) among TKD athletes across Pakistan. Participants were recruited from clubs officially registered with the Pakistan Taekwondo Association, representing all four provinces: Punjab, Sindh, Khyber Pakhtunkhwa, and Baluchistan as well as the federal capital, Islamabad. To determine the required sample size, the Raosoft sample size calculator was utilized based on an estimated national population of 2,050 Taekwondo players. A minimum sample size of 324 was initially targeted to ensure statistical validity. Out of the total responses received, 10 were excluded due to incomplete information, resulting in a final sample of 314 participants whose data were included in

the statistical analysis. A convenience sampling technique was employed to gather responses from athletes across various regions.

The data collection process was coordinated in collaboration with the Secretary General of the Pakistan Taekwondo Association. Official communication was established with registered club coaches, who were invited to assist in the recruitment process. Lists of active TKD players were obtained via email from the respective coaches. To ensure consistency in clinical assessment, the Windlass test was selected as the primary tool for diagnosing signs of plantar fasciitis. Standardized protocols for administering the test were provided to the designated officials and coaches at each club. A structured data collection form was created using Google Docs, which included an informed consent section, demographic details, and fields for recording clinical findings.

The designated officials conducted the Windlass test according to the provided instructions, obtained consent from each participant, and recorded the results directly into the online form. BMI was also assessed as part of the study. Participants were asked to provide their height (in meters) and weight (in kilograms), which were used to calculate BMI using the standard formula: BMI = weight (kg) / height (m^2). Based on the WHO classification, participants were categorized into underweight (≤18.5), normal weight (18.6–25), overweight (25.1–30), and obese (≥30).

Eligibility criteria included male and female TKD players aged between 12 and 50 years who were currently registered with an official club. Exclusion criteria included players with systemic medical conditions, recent or chronic foot injuries, congenital foot deformities, or those outside the specified age range. Ethical approval was obtained from the relevant institutional review board before data collection. All participants were informed about the purpose of the study, and participation was voluntary. The collected data were compiled electronically and analyzed using IBM SPSS version 25, and the frequency and percentages were calculated. Association between plantar fasciitis and BMI category was evaluated using chi-square test ($p<0.05$ considered significant).

RESULTS

The present study included a total of 314 participants, comprising 51 females (16.2%) and 263 males (83.8%). Participants' ages ranged from 12 to 52 years, with a mean age of 25.41 years (SD=8.50). Out of 314 players, 96 (30.6%) were from Punjab, followed by 67 (21.3%) from Sindh, 66 (21%) from KPK, 52 (16.6%) from Islamabad Capital Territory, and 33 (10.5%) were from Baluchistan. Out of the 314 Taekwondo players who responded, the Windlass test was performed to assess the prevalence of plantar fasciitis.

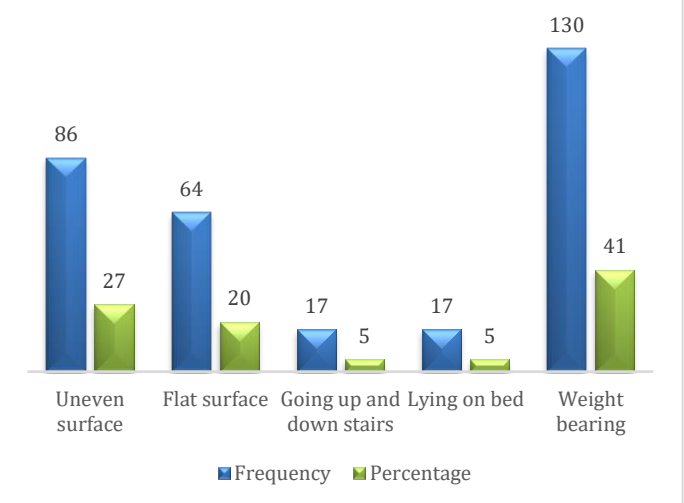
Among the participants, 72 players (22.9%) tested positive, indicating clinical signs of plantar fasciitis, while 242 players (77.1%) tested negative, as shown in Table 1. This suggests that nearly one-fourth of the athletes experienced biomechanical findings consistent with plantar fasciitis. The most aggravating factor was weight bearing (41%), followed by walking on uneven surfaces (27%) and walking on flat surfaces (20%), while lying on the bed and going up and down stairs showed the lowest percentages, each at 5% (Figure 1).

Table 2 shows the association between BMI and heel pain, which was assessed using cross-tabulation and a Chi-square test. Participants in the normal BMI range (18.6–25) formed the majority of the sample, representing 69.4%, while 14% were underweight (≤18.5), 11.8% were

Table 1: Windlass test result

Status	Frequency	Percentage (%)
Positive	72	22.9
Negative	242	77.1
Total	314	100

Figure 1: Pain aggravating factors



overweight (26–30), and 3.5% were obese (≥31). Within the normal BMI group, 66 individuals reported current heel pain, 126 reported no pain, and 26 indicated a history of heel pain. Only a small number of participants in the higher BMI categories reported heel pain. The Chi-square analysis produced a value of 6.50 with 6 degrees of freedom and a p-value of 0.36. Since the p-value was greater than 0.05, the findings suggest that BMI category and heel pain were not significantly associated in this study population.

Table 3 shows the association between age and heel pain was examined using cross-tabulation. The majority of participants belonged to the 16–25 years group, making up 58.3% of the sample, followed by the 26–35 years group at 21.7%. In the 16–25 years group, 46 individuals reported current heel pain, 114 reported no pain, and 23 had experienced it in the past. Heel pain was also reported among participants aged 26–35, with 22 current cases and 8 past cases. In contrast, the youngest group (15 years or less) and the oldest group (46 years or more) represented a much smaller proportion of the sample, accounting for 6.7% and 3.8% of participants, respectively, with fewer cases of heel pain reported. Overall, out of 314 participants, 88 (28%) reported current heel pain, 186 (59.2%) reported no pain, and 40 (12.7%) indicated a history of heel pain. The Chi-square test resulted in a value of 3.12 with 4 degrees of freedom and a p-value of 0.53, indicating that the association between age group and heel pain was not statistically significant.

DISCUSSION

The prevalence of plantar fasciitis identified in the present study (22.9%) among Taekwondo athletes is notably elevated when compared to other athletic and occupationally active populations reported in recent literature. A systematic review and meta-analysis by Hamstra-Wright et al. (2021) investigated plantar fasciitis risk factors in physically active individuals and reported prevalence estimates ranging from 5.2% to 17.5% across various sports, including running and field-based activities.[12] These figures are considerably

Table 2: Association between BMI and heel pain

BMI category	Do you have heel pain?			
	Yes	No	History of pain	Total
<18.5	7(2.2)	31(9.9)	6(1.9)	44(14)
18.6–25	66(21)	126(40.1)	26(8.3)	218(69.4)
26–30	9(2.9)	20(6.4)	8(2.5)	37(11.8)
>31	3(1)	6(1.9)	2(0.6)	11(3.5)
Total	85(27.1)	183(58.3)	42(13.4)	314(100)

Table 3: Association between age and heel pain

Age group	Do you have heel pain?			
	Yes	No	History of pain	Total
<15	8(2.5)	12(3.8)	1(0.3)	21(6.7)
16–25	46(14.6)	114(36.3)	23(7.3)	183(58.3)
26–35	22(7)	38(12.1)	8(2.5)	68(21.7)
36–45	6(1.9)	17(5.4)	7(2.2)	30(9.6)
>46	6(1.9)	5(1.6)	1(0.3)	12(3.8)
Total	88(28)	186(59.2)	40(12.7)	314(100)

lower than those observed in the current martial arts cross-sectional study, likely due to the uniquebiomechanical demands of Taekwondo, such as barefoot training, high-impact kicking, and repetitive jumping movements that contribute to cumulative plantar loading.

A prospective cohort study by Wang et al. (2023) further reported a one-year incidence of plantar fasciitis of 2.5% among runners and 2% among non-runners[13], reinforcing the impression that endurance-based activities may carry a lower mechanical burden on the plantar fascia than multidirectional or explosive sports like TKD. In comparison to this, Ul Abidin et al. (2019) found a prevalence of 13.2% among security forces personnel in Pakistan, a group exposed to prolonged standing and moderate physical exertion, yet with less dynamic foot loading.[14] These comparisons highlight that while plantar fasciitis is a common concern across various populations, its prevalence is significantly influenced by the nature and intensity of physical activity, with martial arts players such as TKD athletes facing distinct biomechanical risks.

Martial arts, particularly TKD, are known to increase stress on the lower extremities. A meta-analysis found that the foot and ankle were the second most commonly injured regions in competitive TKD, after the knee.[15] These injuries were often associated with barefoot training and high-intensity movements on hard surfaces. Given this context, it is not surprising that nearly one in four TKD players in the current study tested positive for plantar fasciitis. In comparison to our study, a higher prevalence has been reported among nurses in government tertiary care hospitals of Peshawar, likely due to prolonged standing and occupational strain, underscoring the role of activity-specific risk factors.[16] Although the nature of physical activity differs between athletes and healthcare workers, both groups are exposed to repetitive stress on the plantar fascia, highlighting the need for targeted preventive strategies across physically demanding professions.

Despite the high prevalence of plantar fasciitis, no statistically significant association was found between BMI and plantar fasciitis among Taekwondo Players. In contrast to our study, the patients with plantar heel spurs reported a positive correlation between obesity (raised BMI) and the condition[17], suggesting that the role of BMI may vary depending on the population and underlying biomechanical factors. Another study conducted among hospital staff in Dhaka reported a positive association, indicating that occupational posture and weight-bearing patterns may influence the role of BMI in the development of plantar fasciitis.[18] The absence of such an association in the current study may be attributed to the composition of the sample: Taekwondo athletes tend to have greater lean body mass, and the BMI measure alone does not differentiate between fat and muscle. Therefore, a higher BMI in athletes may reflect greater muscularity rather than increased fat-related mechanical load.

Similarly, the lack of significant association between age and plantar fasciitis in this study deviates from findings in non-athletic populations. A recent study conducted in the Jazan region found that older age (40–55 years and 56–65 years) was significantly associated with increased odds of developing plantar fasciitis (OR ≈ 2.15 for 40–55 years; OR ≈ 3.58 for 56–65 years).[19] However, the majority of the current study's participants were in the 16 to 25 years age group, suggesting that the sample may not have included enough older individuals to capture an age-related development. Younger athletes typically benefit from better tissue elasticity, faster recovery, and lower degenerative risk, which may explain the weak relationship between age and plantar fasciitis in this context.

These findings support the importance of considering population-specific dynamics when evaluating risk factors. In sports populations, traditional factors such as age and BMI may not operate in the same way as in sedentary or occupational populations. Beeson emphasized that among athletes, variables such as training volume, footwear, surface hardness, rest periods, and intrinsic biomechanics may play a more significant role than general demographic indicators.[20] While these factors were not directly assessed in the current study, they warrant further investigation.

CONCLUSION

This study found a 22.9% prevalence of plantar fasciitis among Taekwondo players, with weight-bearing activities being the most commonly reported aggravating factor. Despite common assumptions, no significant associations were observed between plantar fasciitis and either BMI or age, indicating that other sport-specific factors

may contribute more prominently to its development in this athletic population. The findings highlight the importance of early screening, appropriate training practices, and preventive strategies tailored to the physical demands of Taekwondo to reduce the risk and impact of plantar fasciitis among players.

DECLARATIONS

Consent to participate: Written consent had been obtained from patients. All methods were performed following the relevant guidelines and regulations.

Availability of Data and Materials: Data will be made available upon request. The corresponding author will submit all dataset files.

Competing interests: None

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