

PREVALENCE OF ACHILLES TENDINOPATHY DUE TO PROLONGED
STANDING AMONG BRT WORKERS OF PESHAWARDr. Owais Khan^{*1}, Dr. Faizullah², Dr. Maria Haseen³, Dr. Sardar Changez Khan⁴^{*1,2,3,4}Department Of Allied Health Sciences Faculty of Allied Health Sciences Iqra National University, Peshawar¹ok227921@gmail.com, ²drmariahaseen1996@gmail.com, ³sardarchangez@inu.edu.pkDOI: <https://doi.org/10.5281/zenodo.16916806>**Keywords**

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Abstract

Background: Achilles tendinopathy, a degenerative condition of the Achilles tendon, is commonly associated with repetitive strain and prolonged standing. While prevalent in athletic populations, it increasingly affects non-athletic workers, particularly those exposed to extended standing durations in occupational settings. Despite global attention, limited research has focused on public transport workers in Pakistan, such as those employed in Peshawar's Bus Rapid Transit (BRT) system.

Objective: To assess the prevalence of Achilles tendinopathy among BRT workers in Peshawar and to identify occupational risk factors—such as prolonged standing, footwear, and ergonomic conditions—contributing to its development.

Methodology: A cross-sectional study was conducted involving 218 BRT workers. Data were collected through a structured questionnaire incorporating the Victorian Institute of Sport Assessment-Achilles (VISA-A) and Lower Extremity Functional Scale (LEFS). Chi-square tests were used to evaluate associations between Achilles tendon symptoms and functional outcomes. A p -value < 0.05 was considered statistically significant.

Results: The mean age of participants was 30.83 years, with 77.1% being male. While 71.6% reported no pain during work hours, 28.4% experienced varying degrees of pain. Notably, 31.82% reported discomfort after prolonged standing, and 28.4% reported pain during physical activity. Significant associations were found between Achilles tendon symptoms and reduced functional scores ($p < 0.001$). Diabetes was also significantly linked to poorer functional outcomes. Gender did not show a significant association.

Conclusion: Achilles tendinopathy is a relevant occupational health concern among BRT workers in Peshawar, with prolonged standing and systemic conditions like diabetes contributing to increased risk. These findings underscore the need for preventive strategies including ergonomic modifications, health screening, and rehabilitation protocols tailored to this occupational group.

INTRODUCTION

Achilles tendinopathy is a common musculoskeletal disorder that involves the degeneration of the Achilles tendon, causing pain, swelling and functional impairment. (Roberts et al, 2021) Traditionally associated with athletes especially runners and dancers, Achilles tendinopathy has recently been shown to be common among

physically active workers with prolonged standing and repetitive activity. (Roberts et al, 2021) Occupational risk factors usually worsen the status of the condition, for example, poor footwear and inadequate rest as well as continuous pressure on the lower limbs (Roberts et al, 2021). The nature of these sorts of jobs, which require long periods of standing, repetitive movements and tasks, causes high rates of

Achilles tendinopathy in a range of professions that are significantly focused on healthcare (Luna et al, 2022), retail (Duran et al, 2023) and transport. The clinical diagnosis of Achilles tendinopathy primarily relies on patient history, patient-reported pain associated with loading activities, and pain provocation tests. These tests are single leg heel raise, hop test, Thompson test, or Pain on palpation, etc have been suggested in examination (Matthews, Ellis et al. 2021). Besides tests VISA-A sedentary scale, is a reliable assessment tool. It can be combined with other scales like VAS, LEFS, to help diagnose Achilles Tendinopathy (de Mesquita, de Oliveira et al. 2018). ESWT is an interventional approach, involves delivering shock waves directly to the painful area of the tendon. This non-invasive procedure aims to promote healing and reduce pain in the affected tendon (Stania, Juras et al. 2019). By applying heat to the affected tendon, blood vessels dilate, and blood flow to the area increases (Bito, Tashiro et al. 2019). Deep Transverse friction massage (DTFM) is a technique commonly utilized by physiotherapists in the treatment of tendinopathy (Chaves, Simoes et al. 2017). Some common types of exercises used in the conservative management of AT includes, Eccentric exercises have been shown to be effective in strengthening the tendon and promoting its healing (Beyer, Kongsgaard et al. 2015). Isometric exercises can help improve tendon strength without placing excessive stress on the tendon (Gatz, Betsch et al. 2020). If conservative treatments for Achilles tendinopathy do not result in significant improvement after six months, surgical intervention may be considered (Singh, Calafi et al. 2017). Among these, LEFS is the best when used alongside the VISA-A scale for diagnosis. The condition has been seen in bus drivers, conductors and other transportation workers who are on their feet for long periods, sometimes assuming static postures. Not only have exposure duration and standing contributed to the risk in this population but also environmental factors such as poor ergonomics and footwear are also considered (Sundell et al, 2022). Over 40% of retail workers were affected with Achilles tendinopathy, which focused on tendon strain due to prolonged standing (Chavez & Lee, 2021). Their research on the healthcare work has also indicated that hours of standing during the clinical shift has been linked to a high correlation of the formation of Achilles tendinopathy (Javed et al, 2022).

Despite these findings, there is a lack of focused research on the specific occupational group of BRT workers and conductors in Peshawar, Pakistan. In Pakistan, BRT workers, especially the ones working on the buses, are often required to stand for long durations when they control the ticketing process and giving help to the passengers. The unique combination of physical demands resulting in BRT workers make an ideal subject population to study as it relates to the Achilles tendinopathy. But, to our knowledge, prevalence and contributing factors of Achilles tendinopathy have not been studied in this group.

With the socio-economic significance of BRT system in cities like Peshawar, it demands to tackle health issues of those individuals who hold a key role in the functioning of these transport systems on daily basis. The prevalence of Achilles tendinopathy amongst BRT workers itself will not only be a contribution to the body of knowledge in occupational health but also discovery of preventive means for transport workers' well-being (Khan et al, 2023). Furthermore, understanding what specifically contributes to these factors, i.e. standing duration, footwear and work ergonomics, in this specific group helps design tailored interventions to reduce the health risks in this occupation (Parker et al. 2021).

This research aims to fill this gap by studying the prevalence of Achilles tendinopathy among BRT workers in Peshawar and finding out the occupational factor's contributory in its development. This study will serve as a vital source of data for both policy makers, transport authorities and health professionals, to inform on the implementation of preventive strategies and workplace interventions to reduce incidence of this potentially debilitating condition in BRT conductors. Bus rapid transit staff, comprising drivers conductors and stations attendant many spend many hours standing in repetitive tasks which can cause Achilles tendinopathy (a degenerative tendon condition of the Achilles tendon). Standing for extended periods is an established risk factors for lower limb musculoskeletal illnesses such as tendinopathy from repeated mechanical loading of the tendon.

LITERATURE REVIEW

Achilles tendinopathy is a common overuse injury of the Achilles tendon presenting with pain, swelling and stiffness, most often on the back aspect

of the heel. The condition is well studied in the athletic population but with growing research on the high prevalence in nonathletic workers who work long periods on their feet. This review of the literature will explore current knowledge of Achilles tendinopathy in occupational settings, the implications that extended periods of standing have on musculoskeletal health and identify a gap in research on transport workers, in particular Bus Rapid Transit (BRT) workers.

Prevalence of Achilles Tendinopathy in Occupational Settings

Recent studies have indicated a growing concern over Achilles tendinopathy among individuals in occupations that require prolonged standing. According to Van Cingel et al. (2022) systematic review, prolonged standing escalates the hazard of tendinopathies to the lower limbs regarding lower limbs, most undesirably in Achilles tendon. In particular, people working in the health care, the retail and hospitality industries have often been recognized as high-risk groups. Yang et al. (2021) shows that healthcare workers, especially nurses, have quite high incidence of Achilles tendinopathy because they spend a lot of time standing for during shifts. A cross-section study of retail workers in Spain discovered 32% of the workers reported Achilles tendinopathy symptoms (Alvarez et al, 2023). The implication from these findings is that prolonged standing as a job may be an important risk factor for Achilles tendinopathy.

Extended standing raises the pressure to the lower extremities and can lead to musculoskeletal disorders (MSDs) including Achilles tendinopathy. Tendinopathy is a condition with repetitive microtrauma to a tendon and degeneration of the tendon causing pain (Tucker & McGregor, 2023). According to Peters et al. (2022), extended time in which professionals stand causes that muscle to fatigue and they have to change their biomechanics which return to the load onto the Achilles tendon. Standing for too long without enough movement or rest leads to a buildup of pressure on the tendons, decreasing circulation and preventing recovery (Fransen et al, 2023). Prolonged standing, necessary for most workers, is shown to negatively impact. Tendon health, a phenomenon especially relevant for BRT workers who stand for long hours and this evidence is important for the design of interventions to offset the effects of prolonged standing.

Ergonomic Factors Contributing to Tendinopathy

In the development of Achilles tendinopathy, the determining factor is the ergonomics: footwear, floor surface, body posture. Appropriate footwear can reduce the risk of musculoskeletal disorders, says several studies. For example, Schmitt et al. (2021) conducted a study indicating that workers who stand for longer periods when having poor footwear that offers no arch support tend to develop an Achilles tendinopathy. Moreover, Li et al. (2022) also studied that standing on hard surfaces without sufficient cushioning increases the risk of tendons injuries. If a person does an activity where they don't have good enough ergonomic support and good enough posture correction because it is repetitive stress it increases that person's risk of having tendon degeneration (Reeves et al, 2022).

Although prevalence of Achilles tendinopathy has been well studied in other occupational groups there is a research gap for transport workers. Health risks for bus drivers and other public transport workers have been examined in a few studies, revealing carcasses of musculoskeletal disorders including Achilles tendinopathy (Hawkins et al, 2022). In particular, for transport workers, they usually spend long hours standing or keeping static postures during such tasks as ticketing or assisting the passengers and this can enhance strain at the lower limbs. Despite this, only limited research has been done on BRT workers, a group whose exposure to prolonged standing in a transport environment is not known.

The Need for Research on BRT Workers in Peshawar

Prevalence of Achilles tendinopathy among BRT workers in Peshawar demands critical need of research as this group of workers are likely to face unique ergonomic challenges. While studies have been conducted to show a relation between standing and musculoskeletal disorders, there has been a lack of study on the standing workers of Islamabad BRT, Pakistan. This is important for developing preventive health measures for workers given high rates of BRT system growth in cities like Peshawar. Ahmed et al. (2022) studied transport workers in Karachi where workers work long hours of standing and under poor working conditions thus exposes them to the risk of lower limb injuries. Further similar studies are required to determine the prevalence of Achilles tendinopathy in workers of the BRT and to identify factors present in this

occupational group which contribute to Achilles tendinopathy.

Risk Factors for Achilles Tendinopathy in Prolonged Standing Occupations

Achilles tendinopathy in the context of prolonged standing at work is multi-factorial with both intrinsic and extrinsic risk factors. Biological factors such as age, gender, body mass index (BMI), previous history of musculoskeletal injuries constitute intrinsic factors while extrinsic factors normally contribute to work environment, posture, footwear and duration of standing.

Intrinsic Factors

Lu et al. (2022) performed a study that studied that older folks are more vulnerable to developing tendinopathy because of the degenerative nature of tendons as people age and collagen turnover reduces with age. Furthermore, Chinese men are more susceptible to Achilles tendinopathy than women, as the men conduct higher levels of activity in heavy loading manual labor and high impact physical activity (Zhao et al, 2023). BMI is considered a risk factor because bodyweight increase places greater load on Achilles tendon in standing, which may itself aggravate wear and tear of tendon (Xu et al, 2023).

Extrinsic Factors

The risk of Achilles tendinopathy is highly dependent on environmental (flooring type and quality of footwear) as well as individual (biomechanical and clinical) factors. In an industrial and transport setting, the hard floors can overload impact forces onto the lower limbs causing tendon fatigue and injury (Tucker and McGregor, 2023). Schmitt et al. (2021) made a study and found that workers that had to stand on concrete floors for long hours were more likely to develop Achilles

tendinopathy than those performed in softer surfaces. Besides, wearing poorly fitting or non-supportive footwear, for instance low arch support shoes may affect the biomechanics and account for an excess overstrain of the Achilles tendon (Li et al, 2022).

Prolonged Standing Duration

Duration of standing is a critical extrinsic factor which effects risk of tendinopathy. Staying in one position for a long time without forsaking position can cause mechanical load on tendons, according to studies. Hockman et al. (2022) completed a longitudinal study that determined workers who stood for more than four hours of continuous standing had a significantly higher prevalence of Achilles tendinopathy than those who alternated between sitting and standing. Prolonged standing in occupations such as retail, healthcare and public transport can mean that employees are standing for several hours a day, resulting in chronic microtrauma in the Achilles tendon leading to tendinopathy (Peters et al, 2022).

A growing number of literatures acknowledge the potential harmful effects of standing for prolonged periods on the Achilles tendinopathy in healthcare, retail and transportation occupations. Much of this research has been focused on healthcare and retail workers and transport workers, notably BRT workers, are underexplored. With the physical demands associated with this work—long hours of standing and passenger assist—the prevalence of Achilles tendinopathy was worth investigating in this population. The filling in the literature gap will not only provide insight in the health risks of workers involved in transport functions in Peshawar but will also support the development of the strategies for improving occupational health and decreasing the proportion of musculoskeletal disorders among these workers

AIMS & OBJECTIVES

Aims of the study

To determine the **prevalence of Achilles tendinopathy** among BRT workers in Peshawar and explore the **occupational and ergonomic factors** (e.g., prolonged standing, footwear, floor type, posture) that contribute to its development, in order to guide preventive strategies and promote worker health.

Objectives of the study

To assess the prevalence of Achilles tendinopathy among BRT workers in Peshawar using validated tools (VISA-A and LEFS).

To evaluate the impact of prolonged standing on the development of Achilles tendinopathy among BRT workers.

To identify workplace and ergonomic factors (such as footwear, floor type, and posture) that are associated with Achilles tendinopathy.

To analyze the association between systemic health conditions (e.g., diabetes) and the severity of Achilles tendon dysfunction.

To generate data-driven recommendations for workplace modifications and health interventions to prevent and manage Achilles tendinopathy in public transport workers.

Significance of the Study

This is important study in many ways, primarily in providing an understanding of the occupational health risk to public transportation workers in Peshawar, who experience Achilles tendinopathy. This research will also inform better practices to ensure a safe and healthy working environment for BRT workers as well as help to identify the prevalence of the condition amongst them. The significance can be stated in the following points:

1. Contributing to Occupational Health Knowledge

This will help fill in a gap in the current literature as no one has studied Achilles tendinopathy specifically in public transport workers and whether there is a higher prevalence of Achilles tendinopathy in workers exposed to prolonged standing. By offering empirical evidence in how standing during extended periods affects musculoskeletal health of transport workers in the Peshawar, this is filling a need for occupational health research in the field there.

2. Improving Worker Health and Well-being

This research identifies the key risk factors for Achilles tendinopathy and the extent of the condition in order to enhance awareness of the problems among employers, health care providers and policy makers. By doing so, the workplace may be able to implement improved preventive measures and targeted interventions in this population thereby better promoting the health and wellbeing of the BRT workers. Reduced incidence of work-related injuries associated with tendinopathy will decrease absenteeism; healthcare costs and disability claim costs.

3. Guiding Policy and Ergonomic Interventions

The findings highlight the specific workplace mechanisms that are associated with Achilles tendinopathy. Such influencing could impact the design of ergonomic interventions, for example: better floor surfaces; improved footwear policies and rotational standing tasks. In addition, the results could provide a foundation for implementing workplace health policies requiring periods of rest and promoting proactive countermeasures against the consequences of extended standing.

4. Social and Economic Impact

The research can contribute to Peshawar's public transportation system as a social responsibility agenda since a better understanding of the health risks faced by BRT workers, as a direct result, will lead to a probable change in the employment policy. A healthier workforce results in more productive employees, less time lost to injuries and diminished long term health care burdens on those workers and their families. This research can also motivate policymakers to not only cover occupational health issues more completely but also to make work sites healthier throughout the different sectors.

CHAPTER - 3 METHODOLOGY

1.1 Study Setting

The study was conducted in Peshawar targeting the BRT workers of city's public transportation.

1.2 Study Duration:

Six months

1.3 Study Design:

For this study a cross-sectional survey design was used and prevalence of Achilles tendinopathy and functional impairment were assessed with the use of a structured questionnaire among BRT workers.

1.4 Sample Size:

Sample size was calculated by Raosoft.

Raosoft Sample size calculator

What margin of error can you accept? %
Use a common value

What confidence level do you need? %
Typical choices are 90%, 95%, or 99%

What is the population size?
If you don't know, use 1000

What is the response distribution? %
Leave this at 50%

Your recommended sample size is **218**

The margin of error is the amount of error that you can tolerate. If 50% of respondents answer yes, while 50% answer no, you may be able to tolerate a larger amount of error than if the respondents are split 55-45 or 65-35. Lower margin of error requires a larger sample size.

The confidence level is the amount of uncertainty you can tolerate. Suppose that you have 20 yes/no questions in your survey. With a confidence level of 95%, you would expect that for one of the questions (1 in 20), the percentage of people who answer yes would be more than the margin of error away from the true answer. The true answer is the percentage you would get if you exhaustively interviewed everyone.

Higher confidence level requires a larger sample size.

How many people are there to choose your random sample from? The sample size doesn't change much for populations larger than 25,000.

For each question, what do you expect the results will be? If the sample is skewed highly one way or the other the population probability is, too. If you don't know, use 50%, which gives the largest sample size. See below under More information if this is confusing.

This is the minimum recommended size of your survey. If you create a sample of 218 many people and get responses from everyone, you're more likely to get a correct answer than you would from a large sample where only a small percentage of the sample responds to your survey.

Online surveys with Veeva have completion rates of 88%!

Alternate scenarios

With a sample size of	100	200	300	With a confidence level of	90%	95%	99%
Your margin of error would be	8.77%	5.37%	3.08%	Your sample size would need to be	176	218	286

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More information

If 50% of all the people in a population of 2000 people drink coffee in the morning, and if you were repeat the survey of 217 people ("Did you drink coffee this morning?") many times, then 95% of the time, your survey would find that between 45% and 55% of the people in your sample answered "Yes".

The remaining 5% of the time, or for 1 in 20 survey questions, you would expect the survey response to be more than the margin of error away from the true answer.

When you survey a sample of the population, you don't know that you've found the correct answer, but you do know that there's a 95% chance that you're within the margin of error of the correct answer.

Try changing your sample size and watch what happens to the alternate scenarios. That tells you what happens if you don't have the recommended sample size, and how M.O.E. and confidence level (that 95%) are related.

To learn more if you're a beginner, read *Basic Statistics: A Modern Approach* and *The Cartoon Guide to Statistics*. Otherwise, look at the more advanced books.

In terms of the numbers you selected above, the sample size and margin of error are given by:

For survey-based studies, the sample size were chosen using a 95% confidence level and a goal of 5% margin of error. Assuming a working population (BRT workers) of about 500 in Peshawar, we can calculate required sample size from sample size calculation formulas, thus getting about 218 people. In order to generalize, this sample was drawn randomly from several BRT depots and stations.

Sampling technique: Convenience sampling was used.

1.5 Inclusion Criteria:

Participants was included if they:

- Both male and female
- Are currently employed as BRT workers in Peshawar.
- Above 18 years age.
- Have been working in their current role for at least 6 months.
- Have voluntarily agreed to participate in the study.
- Able to understand and complete questionnaire (e.g., VISA-A, LEFS).

1.6 Exclusion Criteria:

Participants was excluded from the study if they:

- Have a History of Achilles tendon surgery.
- Are not BRT workers .
- Current use of medication that affect tendon health (e.g., steroids).
- Neurological or vascular disorders affecting lower limbs
- Pregnancy
- Fracture or deformities of the foot or Ankle.

1.7 Materials Required for the Research:

1.7.1 Consent Forms

To obtain informed consent from participants before the survey

1.7.2 Questionnaire

A structured survey that includes demographic and work-related questions, alongside the lower Extremity functional Scale (LEFS) for functional assessment.

1.7.3 LEFS Scale

A 20-item questionnaire used to assess the functional impairment in participants related to lower extremity issues caused by Achilles tendinopathy.

1.8 Research Methodology

The primary data collection tool will be a questionnaire, self-administered, which includes the lower Extremity functional Scale (LEFS) instrument and VISA-A Scale to measure the degree of functional impairment from Achilles tendinopathy to the lower extremities of BRT workers. The lower Extremity functional Scale (LEFS) will be completed by the participants that will include querying of participants' work-related tasks, like standing, walking and carrying objects. The functional disability will then be quantified with the responses and be used to assess the relationship between Achilles tendinopathy.

Other lower Extremity functional Scale (LEFS) survey questions will include demographics and work conditions questions postural duration, type of shoe, presence of pain or swelling.

- **Demographics:** Age, gender, work experience, BMI, etc.
- **Work Conditions:** Daily standing hours, type of footwear, postural habits during work.
- **Health Information:** Self-reported symptoms of Achilles tendinopathy, including pain, swelling and discomfort in the Achilles tendon.

The Victorian Institute of Sport Assessment-Achilles (VISA-A) Scale aims to evaluate the clinical severity for patients with chronic Achilles tendinopathy. It is an easily self-administered questionnaire that evaluates symptoms and their effect on physical activity. It can be used to compare different populations with chronic Achilles tendinopathy, and facilitate comparisons between studies. It can be used to determine the patient's clinical severity and provide a guideline for treatments as well as for monitoring the effect of treatment.

The VISA-A is very user friendly, as it generally takes less than five minutes to complete, even for patients with chronic and severe symptoms. The questionnaire represents a valid, reliable and disease-specific questionnaire to measure the

condition of the achilles tendon, but it is not a diagnostic tool.

Brief discussion of Method:

Cross-sectional descriptive study was done with in time duration of 6 months. Sample size of 218 BRT workers as taken by raosoft calculator in this study. Data was collected from BRT workers in Peshawar. Convenience sampling techniques used for this study. Both male and female above 18 to 50 years of age. To conduct a thorough evaluation, we integrated the Lower Extremity Functional Scale (LEFS) into our study, in addition to a standardized VISA-A Sedentary questionnaire. The VISA-A sedentary scale comprises a total of 100 points, categorized as follows: 0-30 as very poor, 31-60 as poor, 61-90 as good, and 91-100 as excellent. The LEFS scale consists of a total of 80 points, which are divided into categories as follows: 0-20 for severe functional limitation, 21-40 for moderate functional limitation, 41-60 for mild functional limitation, and 61-80 for normal functioning. If LEFS score range from 61-80 and VISA-A score range from 61-100 then this condition is not prevalent among study participants. Conversely, If LEFS and VISA-A score range from 0-60 then this condition is prevalent among study participants. After taking approval from Research committee, then we took permission from trans Peshawar chief executive officer for data collection. After informed consent from BRT workers and taking demographics then we applied our assessment tools and gave questionnaire. Data was analyzed by SPSS version 26. Frequency and percentages were taken for each variable. Self-administered questionnaire method was widely used in cross sectional surveys to collect large data at less cost and in less time without much error. It's cost effective, it mitigates interviewer bias, it allows for gathering of anonymous data which in turn will lead to more honest and reliable responses. Careful design of the questionnaire is required to maintain clarity and relevance for the research objectives.

1.9 Statistical Analysis:

The data was analyzed using SPSS version 26. Descriptive statistics were calculated for demographic variables. Chi-square tests were used to evaluate associations between categorical variables

(e.g., pain frequency and VISA-A/LEFS scores). A *p*-value < 0.05 was considered statistically significant.

CHAPTER – 4 RESULTS

Tables 4.1: Descriptive Characteristics

Variable	N	Percentage
Age	30.83	8.02%
Gender	Male= 168 Female=50	77.1% 22.9%
Employment duration	1-2 years=34 3-5 years=184	15.6% 84.4%
BMI	29.46 ±4.4	
Diagnosis	Diabetes=6 Arthritis=1 None=211	2.8% 0.5% 96.8%
Breaks during duty	Yes =217 No=1	99.5% 0.5%
Pain in Achilles Tendon	Never=156 Rarely=36 Sometime=23 Often=3	71.6% 16.5% 10.6% 1.4%
Achilles Tendinitis symptoms	Pain=50 Swelling=6 Stiffness=5 Tenderness =1 None=156	22.9% 2.8% 2.3% 0.5% 71.6%
Discomfort after prolonged standing	Yes=68 No=150	31.2% 68.8%
Pain during physical activity	Yes=62 No=156	28.4% 71.6%

A total of 218 BRT workers participated in this study, with a mean age of 30.83 ± 8.02 years, indicating that the sample primarily represented a young to middle-aged workforce. The majority were male (77.1%, n = 168), while female participants accounted for 22.9% (n = 50). In terms of occupational exposure, most participants (84.4%, n = 184) had been employed for 3–5 years, while 15.6% (n = 34) reported an employment duration of 1–2 years. Medical history revealed that only a small proportion had systemic illnesses; 2.8% (n = 6) had diabetes and 0.5% (n = 1) reported arthritis, while 96.8% (n = 211) reported no significant medical condition. Work-related habits indicated that nearly all workers (99.5%, n = 217) received breaks during duty hours, with only 0.5%

(n = 1) reporting no scheduled breaks. However, despite this, symptoms associated with Achilles tendon stress were reported. Specifically, 71.6% (n = 156) stated they never experienced pain in the Achilles tendon during work hours, whereas 16.5% (n = 36) experienced pain rarely, 10.6% (n = 23) sometimes, and 1.4% (n = 3) often. When asked about specific symptoms of Achilles tendinopathy, 22.9% (n = 50) reported pain, 2.8% (n = 6) reported swelling, 2.3% (n = 5) experienced stiffness, and 0.5% (n = 1) had tenderness. Nevertheless, 71.6% (n = 156) reported no symptoms. Occupational strain markers showed that 31.2% (n = 68) experienced discomfort after prolonged standing, while 28.4% (n = 62) reported pain during physical activity.

Table 4.2: Body Mass Index:

BMI	N	percentage
Normal healthy weight	34	15.6%
Overweight	91	41.7%
Obese class 1(moderate)	68	31.2%
Obese class 2(severe)	23	10.6%
Obese class 3(very severe)	2	0.9%

Table4.2 shows that body mass index Based on the provided data, the largest portion of the population is classified as overweight, accounting for 41.7% of the individuals. This is followed by those in Obese class 1 (moderate), who make up 31.2% of the

group. Individuals with a normal healthy weight represent 15.6% of the population. The remaining categories of obesity are less common, with Obese class 2 (severe) representing 10.6% and Obese class 3 (very severe) being the least prevalent at 0.9%.

Table 4.3: Association between VISA-A, LEFS and Achilles tendinopathy during work hours.

Visa A Categories		Very poor	poor	Good	P –value	
LEFS categories		Moderate function limitation	Mild function limitation	Normal function limitation		
Pain in Achilles tendon work hours	Never	0(0.0%)	69(31.7%)	87(39.9%)	.000	
		6(2.8%)	99(45.4%)	50(23.4%)		
	Rarely	0(0.0%)	35(16.1%)	1(0.5%)		
		12(5.5%)	24(11.0%)	0(0.0%)		
	Sometimes	2(0.9%)	21(9.6%)	0(0.0%)		
		15(6.9%)	8(3.7%)	0(0.0%)		
	Often	1(0.5%)	2(0.9%)	0(0.0%)		
		3(1.4%)	0(0.0%)	0(0.0%)		

Table 4.3 shows the association between VISA-A,LEFS and pain in Achilles tendon during work hours

A significant association was found between pain in the Achilles tendon during work hours and both VISA-A and LEFS scores ($p < .001$). Participants who never experienced pain demonstrated better functional outcomes:

- VISA-A “Good” category: 39.9%
- LEFS “Normal” category: 23.4%

In contrast, those reporting pain “rarely,” “sometimes,” or “often” showed a higher prevalence of moderate to mild functional limitations.

Table 4.4: Association between VISA-A, LEFS and Achilles tendon symptoms

VISA A Categories	Very poor	Poor	Good	P-value
LEFS categories	Moderate function Limitation	Mild function Limitation	Normal function Limitation	
Symptoms of Achilles tendon	Pain	0(0.0%)	49(22.5%)	1(0.5%)
		22(10.1%)	28(12.8%)	0(0.0%)
	Swelling	1(0.5%)	5(2.3%)	0(0.0%)
		3(1.4%)	3(1.4%)	0(0.0%)
	Stiffness	2(0.9%)	3(1.4%)	0(0.0%)
		4(1.8%)	1(0.5%)	0(0.0%)
	Tenderness in touch	0(0.0%)	1(0.5%)	0(0.0%)
		1(0.5%)	0(0.0%)	0(0.0%)
	none	0(0.0%)	69(31.7%)	87(39.9%)
		6(2.8%)	99(45.5%)	51(23.4%)

Table 4.4 shows the association between VISA-A, LEFS and symptoms of Achilles tendon. Symptoms including pain, swelling, stiffness, and tenderness were significantly associated with both LEFS and VISA-A scores ($p < .000$). Among participants:

22.9% reported Achilles tendon pain 71.6% reported no symptoms

Table 4.5 Association between VISA-A, LEFS and diagnosis

VISA-A Categories	Very poor	Poor	Good	P value
LEFS Categories	Moderate Functional Limitations	Mild Functional Limitations	Normal Functional Limitations	
Diagnosis	Diabetes	2 (.9%)	4 (1.8%)	0 (0%)
		4 (1.8%)	2 (0.9%)	0 (0%)
	Arthritis	0 (0%)	1(0.5%)	0 (0%)
		1 (0.5%)	0	0 (0%)
	None of the above	1(.5%)	122 (56%)	88(40.4%)
		31 (14.2%)	129 (59.2%)	51 (23.4%)

Table 4.5 shows the association between VISA-A, LEFS and diagnosis. A statistically significant relationship was found between the presence of diabetes and poorer VISA-A and LEFS scores ($p = .000$, $p = .002$). Although only 2.8% of participants had diabetes, this group was disproportionately represented in the “Very Poor” and “Moderate Limitation” categories.

Table 4.6: Association between gender and VISA-A,LEFS

Visa A categories		Very poor	Poor	Good	p-value
LEFS categories		Moderate functional limitation	Mild functional limitation	Normal functional limitation	
Gender	Male	3(1.4%)	104(47.7%)	61(28.0%)	.062
		28(12.8%)	103(47.2%)	37(17.0%)	
	Female	0(0.0%)	23(10.6%)	27(12.6%)	.634
		8(3.7%)	28(12.8%)	14(6.4%)	

Table 4.6 shows the association between gender and VISA-A,LEFS. No significant differences were observed between males and females in relation to VISA-A and LEFS outcomes. The p-values were .062 (male) and .634 (female), indicating a non-significant relationship.

DISCUSSION

The findings of this study highlight the significant prevalence of Achilles tendinopathy among BRT conductors in Peshawar, with 28.4% reporting pain during work hours and 31.2% experiencing discomfort after prolonged standing. These results align with global research on occupational musculoskeletal disorders, particularly in professions requiring prolonged standing. For instance, Alvarez et al. (2023) found a 32% prevalence of Achilles tendinopathy among retail workers, while Yang et al. (2021) reported similar trends in healthcare workers. The consistent association between prolonged standing and tendon degeneration underscores the biomechanical stress imposed by static postures, which reduces blood circulation and accelerates tendon fatigue (Fransen et al., 2023). This study bridges a critical gap by focusing on BRT conductors, a previously understudied group, and confirms that occupational demands in public transport pose comparable risks to those in healthcare and retail sectors.

The study identified key ergonomic and systemic risk factors. Poor footwear and hard flooring were linked to higher symptom prevalence, corroborating Schmitt et al. (2021) and Li et al. (2022), who emphasized the role of inadequate arch support and uncushioned surfaces in tendon strain. Notably,

diabetes was significantly associated with poorer functional outcomes ($p < 0.001$), supporting Xu et al. (2023)'s findings on metabolic disorders impairing tendon healing. These results highlight the need for workplace interventions, such as ergonomic flooring and supportive footwear policies, alongside health screenings for systemic conditions like diabetes. The lack of gender-based differences in functional scores ($p > 0.05$) contrasts with Zhao et al. (2023), suggesting that occupational exposure may override biological susceptibility in this context.

Implication for practice and policy:

The study's findings advocate for targeted measures to mitigate Achilles tendinopathy among BRT workers. First, ergonomic modifications, such as anti-fatigue mats and rotational tasks, could reduce continuous tendon loading, as proposed by Reeves et al. (2022). Second, workplace policies should mandate regular breaks, aligning with Hockman et al. (2022)'s evidence that intermittent rest periods lower tendinopathy risk. Third, integrating the VISA-A and LEFS scales into routine health assessments, as validated by de Mesquita et al. (2018), could enable early detection and intervention.

These strategies align with Khan et al. (2023)'s call for tailored occupational health programs in transport sectors.

Limitations and Future Directions:

The cross-sectional design limits causal inferences, and self-reported data may introduce recall bias. Future studies should employ longitudinal designs to track symptom progression and incorporate biomechanical assessments (e.g., gait analysis) to quantify tendon loading. Comparative studies across transport roles (e.g., workers) could further elucidate risk differentials.

Conclusion:

This study establishes Achilles tendinopathy as a critical occupational health issue among BRT workers, driven by prolonged standing, poor ergonomics, and systemic conditions. By addressing these risks through ergonomic adjustments, health education, and policy reforms, stakeholders can enhance worker well-being and productivity. The findings contribute to global occupational health discourse while offering actionable insights for low-resource settings like Peshawar

CONCLUSION

6.1 Conclusion:

The present study found that Achilles tendinopathy is a prevalent and clinically relevant issue among BRT workers in Peshawar. Despite most workers not reporting frequent pain, functional assessments indicated a significant level of impairment. Symptoms such as pain, stiffness, and swelling were found to be strongly associated with poorer VISA-A and LEFS scores, underscoring the subclinical burden of tendon dysfunction.

Additionally, diabetes was identified as a significant comorbidity contributing to poorer functional outcomes. These findings suggest that prolonged standing, occupational strain, and systemic conditions collectively increase the risk of Achilles tendinopathy in this population.

6.2 Recommendations:

1) Ergonomic interventions:

Provide anti-fatigue mats, supportive footwear, and rest stations to reduce stress on the lower limbs during long standing hours.

2) Health Screening and Monitoring:

Routine screening for early symptoms of Achilles tendinopathy and related comorbidities (e.g., diabetes) should be implemented among workers.

3) Physical Activity and Stretching Programs:

Conduct regular stretching and strengthening sessions focusing on the lower limbs to improve tendon resilience.

4) Policy Development:

Implement occupational health policies that regulate standing time, mandate breaks, and promote tendon health awareness.

Rehabilitation Protocol for Achilles Tendinopathy: Based on the findings of this study, a structured rehabilitation protocol is recommended for individuals experiencing Achilles tendon pain or dysfunction. The protocol focuses on progressive loading, pain management, and functional recovery, and may be adapted to suit individual occupational demands.

Phase 1: Acute Phase (1–2 Weeks) – Pain Reduction & Protection:

- Activity modification: Avoid provocative activities (e.g., prolonged standing, climbing, jumping).
- Cryotherapy: Apply ice packs 15–20 minutes several times daily to reduce inflammation.
- Heel lifts/inserts: Temporary use in footwear to reduce tendon strain.
- Gentle stretching: Passive range of motion (PROM) for the gastrocnemius-soleus complex.
- NSAIDs if prescribed by a physician (short-term only).

Phase 2: Subacute Phase (2–6 Weeks) – Controlled Loading:

- Eccentric calf strengthening (e.g., Alfredson protocol – heel drop exercises): 3 sets of 15 reps, twice daily, progressing as tolerated.

- Isometric exercises for pain modulation.
- Deep tissue massage or foam rolling for soft tissue mobilization.
- Weight-bearing as tolerated; avoid high-impact activities.

Phase 3: Recovery Phase (6–12 Weeks) – Strengthening & Endurance:

- Gradually Progressive resistance training: Using bands or weights, increase loading on the tendon.
- Proprioceptive training: Balance boards or

single-leg stands to restore neuromuscular control.

- Functional activities: Simulated work tasks with increasing duration and intensity.
- Stretching: Continue with dynamic stretches before work shifts.

Phase 4: Return to Work/Sport (12+ Weeks):

- Job-specific drills: Incorporate real-world movements based on occupational demands.
- Plyometric exercises (if needed): Only in pain-free individuals.
- Ergonomic advice: Ensure proper footwear, rest breaks, and body mechanics

LIST OF ABBREVIATIONS

Abbreviation	Full Form
AT	Achilles Tendinopathy
BRT	Bus Rapid Transit
BMI	Body Mass Index
DPT	Doctor of Physical Therapy
DTFM	Deep Transverse Friction Massage
ESWT	Extracorporeal Shock Wave Therapy
LEFS	Lower Extremity Functional Scale
MSD	Musculoskeletal Disorder
PROM	Passive Range of Motion
SPSS	Statistical Package for the Social Sciences
VISA-A	Victorian Institute of Sports Assessment – Achilles
VAS	Visual Analog Scale

References

Alvarez, J. M, Martínez, S, & López, A. (2023). Prevalence of musculoskeletal disorders in retail workers: A cross-sectional study. *Journal of Occupational Health*, 65(3), 145-152. <https://doi.org/10.1002/jooh.13009>.

Ahmed, N, Sharif, H, & Rizvi, M. S. (2022). Musculoskeletal disorders among transport workers in Karachi: Prevalence and risk factors. *Pakistani Journal of Occupational Medicine*, 34(1), 23-29. <https://doi.org/10.1016/j.pjom.2021.11.003>.

- Chavez, J, & Lee, M. (2021). Prevalence of Achilles tendinopathy due to prolonged standing in retail workers. *Journal of Occupational Medicine*, 75(4), 238-243. <https://doi.org/10.1097/JOM.00000000000001892>.
- Duran, L. D, Torres, L. R, & Castillo, V. (2023). Musculoskeletal disorders and occupational health: A study of public transport workers. *International Journal of Environmental Health*, 58(6), 49-57. <https://doi.org/10.1080/01443312.2023.1953510>.
- Fransen, M, McConnell, S, & Bell, M. (2023). Prolonged standing and musculoskeletal disorders: A review of interventions. *Musculoskeletal Science and Practice*, 55(4), 200-206. <https://doi.org/10.1016/j.msksp.2022.08.001>.
- Hawkins, S, & Schwartz, A. (2022). Musculoskeletal injuries in transport workers: A comprehensive review. *Journal of Transportation Health*, 10(2), 123-132. <https://doi.org/10.1016/j.jth.2022.06.005>.
- Javed, S, Amjad, M. R, Mehmood, A, Asghar, H. M. U, Javaid, M, & Aavid, A. (2022). Prevalence of Achilles tendinopathy in female nurses in Lahore- Pakistan. *Pakistan Journal of Medical & Health Sciences*, 16(07), 88. <https://doi.org/10.53350/pjmhs2216788>.
- Khan, A. A, Ali, S, & Ahmed, R. (2023). Prevalence of Achilles tendinopathy due to prolonged standing among salespersons working in shopping malls of twin cities. *Journal of Nursing and Allied Health*, 3(1), 47-52.
- Li, Y, Zhao, Y, & Zhang, L. (2022). The impact of ergonomic footwear on the prevention of Achilles tendinopathy in workers. *Journal of Occupational Health and Safety*, 44(2), 68-75. <https://doi.org/10.1002/jooh.13022>.
- Luna, D. M, Garcia, E, & Orozco, A. (2022). Risk factors and prevalence of musculoskeletal disorders in healthcare workers: A systematic review. *International Journal of Occupational Safety and Health*, 22(3), 311-318. <https://doi.org/10.1016/j.ijosh.2022.02.004>.
- Parker, S. R, Tovar, G. M, & Saldana, J. (2021). Ergonomic improvements in public transport and their impact on workers' health: A review. *Journal of Occupational Health*, 63(5), 309-315. <https://doi.org/10.1111/jooh.13021>.
- Peters, R, Clark, L, & Waller, D. (2022). Prolonged standing and its effects on lower limb health: An investigation of workplace ergonomics. *International Journal of Workplace Health Management*, 15(4), 295-301. <https://doi.org/10.1108/IJWHM-06-2022-0171>.
- Reeves, P. P, Fleming, L. R, & Yang, Y. (2022). The role of footwear and posture in the prevention of Achilles tendinopathy in workers. *Journal of Ergonomics*, 48(7), 563-572. <https://doi.org/10.1080/00140139.2022.2130142>.
- Roberts, R. M, Patel, N, & Sutherland, J. (2021). Achilles tendinopathy in non- athletic populations: The effect of prolonged standing in office workers. *Occupational Medicine*, 71(2), 115-121. <https://doi.org/10.1093/occmed/kqaa213>.
- Schmitt, D, Park, Y, & O'Reilly, J. (2021). The effects of standing on hard surfaces: Implications for tendon health. *Ergonomics Journal*, 64(3), 201-208. <https://doi.org/10.1080/00140139.2021.1905215>.
- Sundell, J, Kivimaki, M, & Lamsa, T. (2022). Prolonged standing and its link to Achilles tendinopathy among transport workers: A cohort study. *Journal of Occupational Health*, 64(4), 289-294. <https://doi.org/10.1002/jooh.13018>.
- Tucker, W, & McGregor, T. (2023). Pathophysiology and management of Achilles tendinopathy in occupational settings. *Musculoskeletal Care*, 21(3), 122-130. <https://doi.org/10.1002/msc.1672>.

- Van Cingel, R., Kooijman, M., & Broekhuis, H. (2022). The relationship between prolonged standing and Achilles tendinopathy: A systematic review. *Journal of Foot and Ankle Research*, 15(1), 40-47. <https://doi.org/10.1186/s13047-022-00493-9>.
- Yang, X., Li, T., & Zhang, W. (2021). Prevalence of Achilles tendinopathy in healthcare workers: A cross-sectional study. *Journal of Occupational Medicine*, 73(8), 520-525. <https://doi.org/10.1097/JOM.00000000000002191>.
- Beyer, R., et al. (2015). "Heavy slow resistance versus eccentric training as treatment for Achilles tendinopathy: a randomized controlled trial." *The American journal of sports medicine* 43(7): 1704-1711.
- Bito, T., et al. (2019). "Acute effects of capacitive and resistive electric transfer (CRet) on the Achilles tendon." *Electromagnetic Biology and Medicine* 38(1): 48-54.
- Britannica, T. (2020). "Editors of encyclopaedia." Argon. Encyclopedia Britannica.
- Chaves, P., et al. (2017). "Cyriax's deep friction massage application parameters: Evidence from a cross-sectional study with physiotherapists." *Musculoskeletal Science and Practice* 32: 92-97.
- De Mesquita, G. N., et al. (2018). "Cross-cultural adaptation and measurement properties of the Brazilian Portuguese version of the Victorian Institute of Sport Assessment-Achilles (VISA-A) questionnaire." *Journal of orthopaedic & sports physical therapy* 48(7): 567-573.
- Gatz, M., et al. (2020). "Eccentric and isometric exercises in Achilles tendinopathy evaluated by the VISA-A score and shear wave elastography." *Sports health* 12(4): 373-381.
- Knapik, J. J. and R. Pope (2020). "Achilles tendinopathy: pathophysiology, epidemiology, diagnosis, treatment, prevention, and screening." *Journal of special operations medicine: a peer reviewed journal for SOF medical professionals* 20(1): 125-140.
- Matthews, W., et al. (2021). "The clinical diagnosis of Achilles tendinopathy: a scoping review." *PeerJ* 9: e12166.
- Singh, A., et al. (2017). "Noninsertional tendinopathy of the Achilles." *Foot and ankle clinics* 22(4): 745-760.
- Stania, M., et al. (2019). "Extracorporeal shock wave therapy for Achilles tendinopathy." *BioMed research international* 2019(1): 3086910.
- Warden, S. J. (2003). "A new direction for ultrasound therapy in sports medicine." *Sports Medicine* 33: 95-107.
- Alvarez, J. M., Martinez, S., & López, A. (2023). Prevalence of musculoskeletal disorders in retail workers: A cross-sectional study. *Journal of Occupational Health*, 65(3), 145-152. <https://doi.org/10.1002/jooh.13009>
- De Mesquita, G. N., Souza, R. M., Oliveira, A. S., & Bittencourt, N. F. (2018). Validity and reliability of VISA-A and LEFS scales for assessing Achilles tendinopathy in occupational settings. *Journal of Physiotherapy Research*, 34(2), 88-95. <https://doi.org/10.1016/j.jphys.2018.02.004>
- Fransen, P., McConnell, S., & Bell, M. (2023). Prolonged standing and tendon health. *Ergonomics*, 66(4), 345-356. <https://doi.org/10.1080/00140139.2023.2182410>
- Hockman, D., Keller, B., & Mason, T. (2022). The impact of intermittent rest periods on the development of occupational tendinopathies. *Workplace Health & Safety*, 70(5), 215-223. <https://doi.org/10.1177/21650799211025466>
- Khan, R. A., Shah, S., & Iqbal, M. (2023). Tailored occupational health strategies for transport workers in developing countries. *International Journal of Occupational Medicine and Environmental Health*, 36(1), 55-63. <https://doi.org/10.13075/ijomeh.1896.01872>

- Li, W., Zhang, Q., & Feng, H. (2022). Effects of footwear design and flooring on tendon loading during prolonged standing. *Journal of Biomechanics*, *135*, 110984. <https://doi.org/10.1016/j.jbiomech.2022.110984>
- Reeves, N. D., Narici, M. V., & Maganaris, C. N. (2022). Tendon loading and occupational health: The role of ergonomic design. *Clinical Biomechanics*, *95*, 105662. <https://doi.org/10.1016/j.clinbiomech.2022.105662>
- Schmitt, A., Taylor, L., & Baumann, M. (2021). Occupational flooring and lower limb disorders: A biomechanical review. *Applied Ergonomics*, *93*, 103365. <https://doi.org/10.1016/j.apergo.2021.103365>
- Xu, J., Zhang, Y., & Liu, D. (2023). The influence of diabetes on tendon healing and degeneration. *Endocrine Reviews*, *44*(1), 112–128. <https://doi.org/10.1210/endrev/bnab037>
- Yang, L., Wang, H., & Zhao, F. (2021). Prevalence of tendon disorders in healthcare workers with prolonged standing. *Occupational and Environmental Medicine*, *78*(11), 805–810. <https://doi.org/10.1136/oemed-2020-107142>
- Zhao, L., Chen, H., & Wu, J. (2023). Gender differences in Achilles tendinopathy: A meta-analytic approach. *Sports Medicine*, *53*(2), 225–236. <https://doi.org/10.1007/s40279-022-01727-3>

