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Provide a context or background for the study (i.e.,the nature of the problem and its significance). State the specific purpose or research objective of, or hypothesis tested by, the study or observation; the research objective is often more sharply focused when stated as a question. Both the main and secondary objectives should be made clear, and any pre-specified subgroup analyses should be described. Give only strictly pertinent references and do not include data or conclusions from the work being reported.

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Discuss your findings by comparing your results with other literature

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Conclusion should elucidate how the results communicate to the theory presented as the basis of the study and provide a concise explanation of the allegation of the findings.

ACKNOWLEDGEMENT

Provide the list of individuals who contributed in the work and grant details where applicable

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THE THERAPIST

JOURNAL OF THERAPIES & REHABILITATION SCIENCES

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THE THERAPIST JOURNAL OF THERAPIES & REHABILITATION SCIENCES

ISSN Online (2790-7414)
ISSN Print (2790-7406)

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Original Articles

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DOI: https://doi.org/10.54393/tt.v5i03.236

THE THERAPIST
JOURNAL OF THERAPIES & REHABILITATION SCIENCES
https://thetherapist.com.pk/index.php/tt
ISSN (P): 2790-7406, (E): 2790-7414
Volume 5, Issue 3 (July-Sep 2024)

Therapy in Focus: Global Perspectives on Rehabilitation and Healing

OPEN ACCESS

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ARTICLE INFO

How to Cite:
Bashir, B. (2024). Therapy in Focus: Global Perspectives on Rehabilitation and Healing. THE THERAPIST (Journal of Therapies &Amp; Rehabilitation Sciences), 5(03), 01. https://doi.org/10.54393/tt.v5i03.236

Historically, healing practices vary widely across different cultures in different countries. From ancient herbal remedies to early forms of physical therapies. With the complexities of modern life, diverse cultures and countries face unique challenges, so it's essential to share knowledge and best practices globally.

In the 20th century in formalizing therapeutic approaches significant strides were made. The advent of psychotherapy, physical therapy, and occupational therapy created a new era in rehabilitation, scientific inquiry, and evidence-based practice. After this multidisciplinary approach, professionals from different fields began collaborating more closely to address complex health issues. Rehabilitation involves a structural program to help people in a broader way that includes restoring health, regaining skills, disease prevention, treatment, and palliative care. An estimated 1 in 3 people living with a health condition would benefit from rehabilitation [1].

Today, therapies encompass a broad spectrum of practices. Physical therapy improves movement and function through exercise and manual techniques. Occupational therapy helps individuals to develop daily living and working skills. Psychotherapy targets mental health challenges by exploring emotions, behavior, and thoughts.

In many low and middle-income countries, over 50% of the population is left without access to essential rehabilitation services. In Western countries, there is a strong emphasis on evidence-based approaches and specialized care. But now many non-western countries also apply modern therapeutic methods with traditional healing practices. Advancements in the field of technology transformed the field. Digital tools like applications and virtual reality are being increasingly utilized to enhance therapeutic interventions.

Looking ahead, the future of therapy is poised for many transformative changes. The integration of machine learning promises and artificial intelligence, offering personalized treatment plans and improving the outcome predictions. The overall goal of rehabilitation is to help people to get their abilities and regain independence.

In conclusion, therapy's journey from its historical roots to its current form has been marked by advancements in growing global perspectives. Rehabilitation is an important part of health coverage globally. The need to extend the availability of essential rehabilitation is urgent and careful attention needs to be given to the system that delivers rehabilitation services. The ongoing advancement and innovation in the field of technology promise to enhance therapeutic practices and improve lives on a global scale.

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DOI: https://doi.org/10.54393/tt.v5i03.222

THE THERAPIST
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https://thetherapist.com.pk/index.php/tt
ISSN (P): 2790-7406, (E): 2790-7414
Volume 5, Issue 3 (July-Sep 2024)

Original Article

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Association of Craniovertebral Angle with Non- Specific Neck Pain and Functional Limitations among IT Professionals

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ARTICLE INFO

Keywords:
Craniovertebral Angle, Nonspecific Neck Pain, Forward Head Posture, Neck Disability Index

How to Cite:
Kalsoom, H., Noor, T., Andama, G., Javed, A., Waris, A., Tamkeen, M., Khan, Q. H., & Iqbal, I. (2024). Association of Craniovertebral Angle with Non-Specific Neck Pain and Functional Limitations among IT Professionals: Craniovertebral Angle with Non-Specific Neck Pain. THE THERAPIST (Journal of Therapies &Amp; Rehabilitation Sciences), 5(03), 02-06. https://doi.org/10.54393/tt.v5i03.222

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Received Date: 16th August, 2024
Acceptance Date: 27th September, 2024
Published Date: 30th September, 2024

ABSTRACT

There was a strong link between workplace ergonomics and occupational diseases. Work-related illnesses contribute significantly to the total burden of occupational diseases. Information Technology (IT) professionals were more likely to experience physical activity limitations and nonspecific neck pain. **Objective:** To determine the association of craniovertebral angle (CVA) with nonspecific neck pain and functional limitations among IT professionals. **Methods:** Total 377 IT professionals participated in an observational cross-sectional survey. Non probability convenience sampling technique was used. CVA was evaluated using a manual goniometer, non-specific neck pain was measured using NPRS, and functional limitation was assessed by using the Neck Disability Index (NDI) questionnaire. The association of CVA with non-specific neck as well as functional restrictions was then found. **Results:** The mean age of this study was 29.43 ± 5.081. About 71.4% were males and 28.6% were females. The results showed that there was significant association of CVA with functional limitation (p value=0.01) and gender (p value =0.05). Also, a significant association was noted between functional limitations and non-specific neck pain (p value =<0.001). Contrastingly, no significant association of CVA observed with non-specific neck pain (p value =0.859) and with BMI (p value =0.721). **Conclusions:** The study concluded that there was no significant association of CVA with non- specific neck pain but recorded a significant association between CVA and functional limitation among IT professionals. Males were having a higher prevalence of forward head posture as compared to females.

INTRODUCTION

Work related musculoskeletal disorders are the main cause of occupational illness burden and are closely associated with workplace ergonomics among which neck pain are most prevalent [1,2]. Neck pain is a multifaceted issue that affects the overall population [3]. Neck pain can range in severity from mild to severe, and it is regarded as a major health concern with significant financial consequences. Neck problems can be caused by poor body alignment, discomfort in the neck area, injuries experienced while working or playing sports, and psychological illnesses such as anxiety and depression [4]. The majority of episodes of discomfort in the neck are classed as non-specific, because their explanation is generally unknown [5]. Approximately 70% of people have neck discomfort at least once in their lives, and 10-15% of the population suffers from neck pain-related impairment. The incidence of neck pain among persons working in office settings ranges between 42% and 63% [6]. Extended use of desktop computers in adults while working has been associated to the development of forward head posture, a condition that leads to musculoskeletal pain or discomfort [7]. Forward Head Posture (FHP) is the most prevalent sagittal plane postural anomaly linked to neck pain [8]. Office workers with neck problems frequently have a marked forward head

DOI: https://doi.org/10.54393/tt.v5i03.222

posture. CVA is a commonly used method for assessing the head position [9, 10]. The term "FHP" refers to the head's anterior position in relation to the vertical line of gravity, as seen in the sagittal plane [11]. When the head is positioned forward, an inappropriate application of force of 30 pounds on the cervical spine occurs, which can induce spinal misalignment [9]. According to research, Forward Head Posture (FHP) is associated with changes in the Craniovertebral Angle (CVA). The CVA is the intersection of the line traveling through the C7 spinous process and the line that extends from the tragus of the ear to the skin of the spinous process. CVA, neck pain, and Forward Head Posture (FHP) are all related. The study also found that people with a smaller Craniovertebral Angle (CVA) were more likely to have forward head posture (as CVA of less than 48-50 degree is defined as Forward Head Posture) and more likely to have neck discomfort [8, 12]. Approximately 60 to 70 percent of individuals may experience discomfort at some stage throughout their professional career. Furthermore, a research examining the prevalence of neck discomfort revealed that 62.1% of those who use computers had experienced neck pain at some point [13]. Another contributing issue is that computer workers engage in less physical activity due to their job on computers. IT workers utilize laptops or desktop computers for extended durations on a regular basis in their workplaces. The prolonged use of desktops or laptops increases the susceptibility of IT professionals to develop forward head position, which in turn increases the likelihood of experiencing non-specific neck discomfort. This neck ache might hinder their productivity at work.

This study aimed to determine the correlation between the craniovertebral angle and non-specific neck discomfort and functional limitations in IT workers.

METHODS

This observational cross-sectional study was conducted on 377 IT professionals who were in 20- 45 years of age. This sample size was calculated through Raosoft software by assuming the unknown population of 20,000 and setting the confidence interval to 95% and power 80% [14]. Non-probability purposive sampling technique was used. The inclusion criteria was IT professionals (including both junior IT clerks having Diploma in IT and professionals having formal university degree), both male and females and working for at least >3hrs/day on Desktop/laptop. An experience of IT work for at least 1 year was mandatory [12]. Cervical Vertebrae fracture from last six months, people with medical condition like vertigo, rheumatoid arthritis, congenital neck problems, radiating neck pain, tumor in cervical region, deformity of spine like scoliosis or kyphosis presence of acute neck pain history of traumatic neck injury, radiculopathy or neck myelopathy, disturbances of the vestibular system and auditory impairment were excluded [6, 15]. Data were collected from total 7 small scale IT software houses, call centers, and from various hospitals' IT staff in Lahore from April 2024 to June 2024. The software houses were approached online and data were collected after the HRs approval and participant's consent. The rest of the data were collected from call centers and It departments after permission from the relevant authorities. Following approval from the research committee, consent was obtained from each individual. A manual goniometer was utilized to quantify the Craniovertebral Angle (CVA). The Craniovertebral angle (CVA) was assessed while the individual was seated. This was done by determining the angle formed at the point where a line from the middle of the tragus of the ear to the skin overlaying the C7 spinous process intersects with a horizontal line going through the C7 spinous process. The typical Craniovertebral angle was within the range of 48-50 degrees. Forward head position was defined as any angle less than 48 degrees [16]. The NPRS scale was utilized to measure the severity of neck discomfort. The Numerical Rating Scale (NPRS-11) was an 11-point scale used for individuals to report their pain levels. This pain scale was often utilized in one-dimensional assessments. The participant chooses an integer between 0 and 10 that accurately represents the level of intensity. The interpretation was as follows: absence of pain was represented by the value 0, mild pain was represented by values ranging from 1 to 3, moderate pain was represented by values ranging from 4 to 6, and severe pain was represented by values ranging from 7 to 10 [17]. Subsequently, the Neck Disability Index questionnaire was delivered to the participants, who were then instructed to complete the form themselves. The Neck Disability Index (NDI) was employed to assess both the intensity of neck discomfort and the extent of functional impairments [18]. The NDI had 10 areas, with each category being assigned a score ranging from 0 to 5. This resulted in a total score range of 0 to 50. The categories were degree of pain, daily living, lifting, reading, headache, attention level, work, driving, sleep, and leisure activities. The disability levels were categorized as follows: 0–4 for no disability, 5–14 for a light disability, 15–24 for a moderate disability, 25–34 for a severe impairment, and >35 for a complete disability [19, 20]. The greater the degree of disability in the neck region, the higher the score [18]. Using SPSS version 25.0, quantitative data were presented by Mean ± SD and qualitative with frequency and percentages. At the end the association of CVA with non-specific neck pain and functional limitation were analyzed through chi-square test. P-value<0.05 was considered as significant.

RESULTS

The mean age of participants in this study was 29.43 ± 5.081. About 71.4% were males and 28.6% were females (Figure 1).

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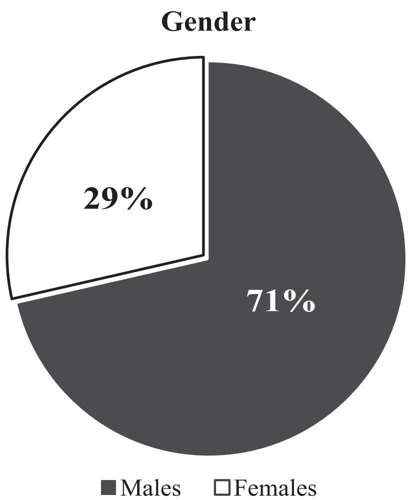

Figure 1: Gender Distribution of study participants

The percentage of single and married were described in (Table 1).

Table 1: Marital Status of study participants

Marital status	N (%)
Marriage	201 (53.3%)
Single	176 (46.7%)
Total	377 (100%)

There was significant association of CVA with NDI (functional limitations) having p-value= 0.01 (Table 2).

Table 2: Association of CVA with NDI (Functional Limitation)

NDI Categories	CVA Categories		Total N (%)	p-Value
	FHP Present N (%)	FHP Absent N (%)		
Normal (0-4)	45 (11.9%)	8 (2.1%)	53 (14.1%)	0.01
Mild Disability (5-14)	204 (54.1%)	36 (9.5%)	240 (63.7%)	
Moderate Disability (15-24)	63 (16.7%)	16 (4.2%)	79 (21%)	
Severe Disability (25-34)	5 (1.3%)	0 (0%)	5 (1.3%)	
Total	317 (84.1%)	60 (15.9%)	37 (00%)	

The results showed non-significant association of CVA with non-specific neck pain with p value=0.859 (Table 3).

Table 3: Association of CVA with NPRS (Non-Specific Neck Pain)

Forward Head Posture (FHP)	NPRS Categories					
	No Pain (Grade 0) N (%)	Mild Pain (Grade 1-3) N (%)	Moderate Pain (Grade 4-6) N (%)	Severe Pain (Grade 7-10) N (%)	Total N (%)	p-Value
FHP Present	43 (11.4%)	111 (29.4%)	115 (30.5%)	48 (12.7%)	317 (84.1%)	0.859
FHP Absent	8 (2.1%)	18 (4.8%)	23 (6.1%)	11 (2.9%)	60 (15.9%)	
Total	51 (13.5%)	129 (34.2%)	138 (36.6%)	59 (15.6%)	377 (100%)	

Another significant association was observed between functional limitations (NDI) and non-specific neck pain (<0.001) (Table 4).

Table 4: Association of Functional Limitation (NDI) with Non-Specific Neck Pain (NPRS)

Neck Disability	NPRS Categories					
	No Pain (0) N (%)	Mild Pain (1-3) N (%)	Moderate Pain (4-6) N (%)	Severe Pain (7-10) N (%)	Total N (%)	p-Value
Normal (0-4)	17 (4.5%)	19 (5.0%)	15 (4%)	2 (0.5%)	53 (14.1%)	<0.001
Mild Disability (5-14)	32 (8.5%)	93 (24.7%)	90 (23.9%)	25 (6.6%)	240 (63.7%)	
Moderate Disability (15-24)	2 (0.5%)	17 (4.5%)	30 (8.0%)	30 (8.0%)	79 (21%)	
Severe Disability (25-34)	0 (0%)	0 (0%)	3 (0.8%)	2 (0.5%)	05 (1.3%)	
Total	51 (13.5%)	129 (34.2%)	138 (36.6%)	59 (15.6%)	377 (100%)	

The correlation of age and NDI showed a significant association (p-value=0.01) and negative correlation (Table 5).

Table 5: Correlation of Age and NDI among study participants

Correlation	Age	NDI	p-Value
Age Pearson Correlation	0.9	-0.127	0.01
NDI (Functional Limitation) Pearson Correlation	-0.127	0.9	

DISCUSSION

As this study was conducted for the association of CVA with non-specific neck pain and functional limitations among IT professionals, the results showed significant association of CVA with functional limitation and non-significant association of CVA with non-specific neck pain. On the other hand, there was no association of functional limitation with non-specific neck pain among IT professionals. There was no significant association of CVA with BMI. Only 162 IT professionals out of 198 were having FHP with normal BMI. Similarly, the ratio of FHP among male's IT professionals was more than females. Out of 377 IT professionals, 232 males were suffering from FHP while only 85 females were having FHP. Worlikar AN *et al.*, in 2022 undertook a study to investigate the correlation between the craniovertebral angle and neck pain in undergraduate students. The study indicated a weak negative association (r value= -0.157) which was similar to our study findings [12]. Wagachchi DT *et al.*, in 2024 investigated the assessment of forward head posture in information technology employees experiencing neck pain. The results of this study showed that 84.3% of male participants and 92.91% of female participants had Forward Head Posture (FHP) [9]. The findings of this investigation differed somewhat from those of this study. Wagachchi DT *et al.*, in 2020 study sought to determine the prevalence of Forward head posture among sewing machine operators in two specific clothing factories [9]. The study also aimed to investigate

DOI: https://doi.org/10.54393/tt.v5i03.222

the association between Craniovertebral Angle (CVA) and the severity of neck pain experienced by sewing machine operators. The prevalence of Forward Head Position (FHP) among sewing machine operators was determined to be 64.67%. FHP was shown to be prevalent in 77.45% of sewing machine operators who experienced neck pain. The study discovered a high prevalence of Forward Head Position (FHP) among sewing machine workers. Furthermore, there was a significant weak negative correlation between Craniovertebral Angle (CVA) and level of neck pain [8] which was consistent with this study. The key confounding factor was the existence of people who did not completed the NDI forms in a serious manner and instead opted for non-serious completion. Some women expressed ethical concerns about exposing their neck area for CVA measurement. Given these findings, it was crucial to conduct a thorough evaluation, diagnosis and treatment of FHP. Additionally, it was crucial to have understanding of good posture. This study emphasizes the importance for physical therapists to specifically target the correction of forward head position in addition to traditional treatment when treating patients with neck discomfort.

CONCLUSIONS

The study concluded that there was no significant association of CVA with non- specific neck pain and significant association of CVA with functional limitation among IT professionals. Males were suffering from forward head posture more than females.

Authors Contribution

Conceptualization: QHK
Methodology: AJ
Formal analysis: QHK
Writing, review and editing: HK, GA, MT, TN, AW, QHK, II

All authors have read and agreed to the published version of the manuscript

Conflicts of Interest

The authors declare no conflict of interest.

Source of Funding

The authors received no financial support for the research, authorship and/or publication of this article.

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DOI: https://doi.org/10.54393/tt.v5i03.253

THE THERAPIST
JOURNAL OF THERAPIES & REHABILITATION SCIENCES
https://thetherapist.com.pk/index.php/tt
ISSN (P): 2790-7406, (E): 2790-7414
Volume 5, Issue 3 (July-Sep 2024)

Original Article

OPEN ACCESS

Association of Sitting Posture with Low Back Pain Among University Students

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ARTICLE INFO

Keywords:
Sitting Posture, Low Back Pain, University Students, Body Awareness and Postural Habits among Young Adults questionnaire

How to Cite:
Zubair, A., Sohail, S., Sarmad, S., Toqueer, S., & Ahmad, T. (2024). Association of Sitting Posture with Low Back Pain Among University Students: Sitting Posture and Back Pain. THE THERAPIST (Journal of Therapies &Amp; Rehabilitation Sciences), 5(03), 07-11. https://doi.org/10.54393/tt.v5i03.253

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Received Date: 10th August, 2024
Acceptance Date: 26th September, 2024
Published Date: 30th September, 2024

ABSTRACT

Prolonged sitting and rising back pain among students have been linked to reduced motivation toward career-oriented opportunities. **Objective:** To find an association of sitting posture with low back pain among university students. **Methods:** This cross-sectional observational study was conducted of 6-month period at the University of Lahore, using a non-probability convenience sampling technique. A total of 189 university students aged 18–25 years were recruited based on defined inclusion and exclusion criteria. Data were collected through a self-structured questionnaire comprising three sections: demographics, postural habits (using a validated postural awareness questionnaire), and low back pain assessment (using a validated adolescent LBP questionnaire). Statistical analysis was performed using SPSS version 27.0. **Results:** In this observational study of university students aged 18–25, 39% were between 18–21 years old and 60% were 22–25 years. The sample comprised 34% males and 65% females. Most students were enrolled in the English Department (38%), Allied Health Sciences (34%), or Information Technology (27%). Regarding sedentary time, 45% reported sitting for about five hours daily, while 54% sat for five to ten hours. Ergonomic seating was limited only 32% used chairs with back and arm support, while 67% sat on chairs without such features. Postural analysis showed that over half (52%) adopted kyphotic or hyper-lordotic postures, 21% slouched, and just 24% maintained a neutral spine. Overall, 66% displayed poor posture during classes and this rose to 76% at home. **Conclusion:** This study concluded that sitting posture was significantly associated with low back pain.

INTRODUCTION

Low back pain was typically characterized as discomfort localized between the costal margin and the inferior gluteal folds [1]. Discomfort originating in the lumbar region was predominantly identified as lower back pain. Anatomically, the lumbar spine comprised the segment of the vertebral column extending from the twelfth thoracic vertebra (T12) to the first sacral vertebra (S1), forming the lower portion of the spinal axis [2]. Low back pain had historically been classified according to its etiological origins. While most cases were deemed non-specific in nature, a definitive pathological cause was identified in approximately 5 to 10 percent of instances. These specific cases encompassed a range of conditions, including degenerative and inflammatory disorders, infections, neoplasms, metabolic bone diseases, referred visceral pain, psychogenic factors, traumatic injuries, and congenital anomalies. Non-specific low back pain referred to discomfort arising in the absence of any clearly identifiable underlying pathology [3]. The prevalence of low back pain in Pakistan is varied in different studies. Among medical doctors it was calculated as 68% in 3 years [4]. Low back pain had been categorized into acute, sub-acute, or chronic classifications, depending upon its duration and intensity. Owing to its high prevalence, it constituted one of the most common complaints prompting individuals to seek medical attention [5]. Low back pain had represented the foremost contributor to disability within the United States, accounting each year for approximately 4.3 million years lived with disability nearly double the impact attributed to any other medical condition. On a broader scale, an estimated 13 percent of the adult population had endured chronic manifestations of low back pain [6]. Multiple risk factors, a sedentary

DOI: https://doi.org/10.54393/tt.v5i03.253

lifestyle, including prolonged sitting, extended driving durations, and occupational screen exposure, significantly elevated the likelihood of LBP. Additional contributors included excess body weight and tobacco use, extended periods of television viewing, video gaming, and the use of mobile or computer devices had similarly been associated with increased LBP prevalence [7]. The incidence of low back pain remained markedly higher among individuals seated without lumbar support compared to those utilizing ergonomically designed chairs with appropriate backrests [8]. University students had been particularly susceptible to low back pain, largely due to the academic demands that fostered prolonged sedentary behavior. Factors such as postural deviations, intense academic schedules, insufficient sleep, extended periods of study, and protracted classroom attendance had all contributed to musculoskeletal strain [9]. When students adopted non-neutral seated postures, asymmetrical mechanical loading had been exerted upon the spinal column, whereby abnormal tensile and compressive forces acted inappropriately upon spinal structures. This often resulted in deleterious muscular tension and pathological stress across spinal articulations [10]. Therefore, the present study had been conducted to examine the association between sitting posture and the incidence of low back pain among university students. It specifically observed students' sitting patterns, including whether they sat with or without back support.

The rationale behind this investigation lies not only in advancing academic understanding but also in contributing to societal well-being by promoting ergonomic awareness and encouraging preventative strategies to reduce musculoskeletal issues among adults.

METHODS

This study employed an observational cross-sectional design to examine the association between sitting posture and low back pain among university students. The study was conducted from February 2024- July 2024 at University of Lahore. A sample of 189 participants was calculated by using the Raosoft Online Sample Size Calculator with 95% confidence level. Non-probability convenience sampling technique was used. Data were collected using previously validated "Body Awareness and Postural Habits Among Young Adults" questionnaire (score ranged from 0-50. (0-19 scores considered as poor posture and 20-50 scores considered as good posture) and "Modified Nordic Questionnaire (Score ranged 0-5 (No back pain), 6-12 (Mild pain) and 13-18 (Moderate pain) [11, 12]. Inclusion criteria were participants aged 18-25 years, both male and female, with no back pain or injury [13]. Exclusion criteria were students with history of trauma or fracture, Ongoing LBP therapy, under 18 years [14, 15]. SPSS version 27.0 was used for statistical analysis. Categorical variables described as absolute frequencies (n) and relative frequencies (%); continuous variables described as mean ± standard deviation (parametric distributions) or as median and percentiles (nonparametric distributions). The Chi-square test was performed between sitting posture and non-specific low back pain.

RESULTS

This observational study recruited university students aged between 18 and 25 years. Among the participants, 39% were within the 18–21 age brackets, while 60% were between 22 and 25 years of age. Of the total sample, 34% were male and 65% were female. The largest proportion of students (38%) was enrolled in the Department of English, followed by 34% from the Department of Allied Health Sciences and 27% from the Department of Information Technology. Regarding sedentary behavior, 45% of the students reported spending approximately five hours sitting per day, whereas 54% indicated sitting for between five to ten hours daily. In terms of seating arrangements, 32% of the participants used chairs equipped with both back support and armrests, while the remaining 67% sat on chairs lacking such ergonomic features. When evaluating sitting posture, 52% of the students were observed to adopt kyphotic or hyper-lordotic postures, 21% exhibited a slouched posture, and only 24% maintained a neutral spine alignment. Postural assessment revealed that 66% of students demonstrated poor posture while seated in class, whereas 33% maintained a proper sitting posture. At home, the prevalence of poor posture increased, with 76% exhibiting suboptimal postural habits and merely 20% adopting correct sitting posture. Concerning musculoskeletal discomfort, 36% of students reported no back pain, 56% experienced mild back pain, and 24% suffered from moderate levels of discomfort. Statistical analysis revealed a significant association between sitting posture in class and the incidence of back pain, with the severity of back pain increasing as postural quality deteriorated. A similar significant association was observed between sitting posture at home and the prevalence of back pain. Pearson correlation analysis demonstrated a weak negative linear relationship between type of sitting posture and back pain ($r = -0.049$), suggesting that as postural quality declined, the likelihood of experiencing back pain slightly increased.

DOI: https://doi.org/10.54393/tt.v5i03.253

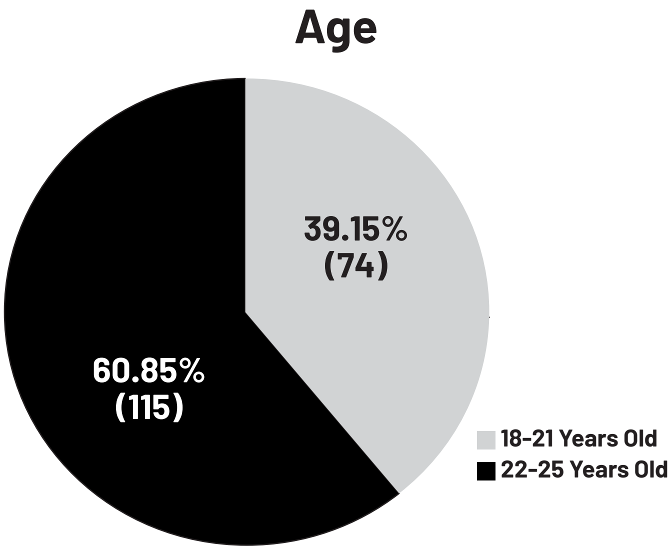

Figure 1: Age Distribution of Study Participants

Table 1 described that 124 out of 189 were female students participated, and 65 male students were participated in this study.

Table 1: Gender Distribution of Participants

Variables	Frequency (%)
Female	124 (65.61)
Male	65 (34.39)
Total	189 (100)

Table 2 described 66% who had poor posture while sitting in class, and 33% adopted good sitting posture in class.

Table 2: Sitting Posture Assessment in Class

Sitting Posture In Class	Frequency (%)
Good	64 (33.9)
Poor	125 (66.5)
Total	189 (100)

Table 3 elucidates 36% reported no back pain, 56% reported back pain but at mild level and 24% reported back pain at moderate level.

Table 3: Non-Specific Low Back Pain

Non-Specific Low Back Pain	Frequency (%)
No	36 (19.05)
Yes, had pain but mild	106 (56.06)
Yes, had pain but moderate	47 (24.87)
Total	189

Table 4 presents the cross-tabulation between students' sitting posture during class and the incidence of reported back pain. There was a statistically significant association between sitting posture at class and back pain, with back pain increasing as posture quality decreased.

Table 4: For Cross-Tabulation (Sitting Posture During Class*Back Pain)

Variables	Back pain			Total	p-Value
	No pain	Yes, had pain but moderate	Yes, had pain but mild		
Sitting posture during class Poor posture	29	59	37	125	0.003
Good posture	7	47	10	64	
Total	36	106	47	189	

The Pearson correlation analysis revealed a week negative linear relationship between sitting posture and back pain (r = -0.049), Table 5.

Table 5: Relationship between Type of Posture and Back Pain

Variables	Type of Sitting Posture	Back Pain
Pearson Correlation	1	-0.049
Significant Value	-	0.03
Number of Cases	189	189

DISCUSSION

The present study identified a high prevalence of poor sitting posture and back discomfort among university students, with 56% reporting mild and 24% reporting moderate levels of back pain, significantly linked to suboptimal posture both in classrooms and at home. In contrast, the cross-sectional research conducted by Arena Ilic *et al.*, in 2021 among Serbian medical students revealed a lower point prevalence of low back pain at 20.8%. While both studies recognized lifestyle-related contributors, Ilic's study highlighted cigarette smoking, academic stress, poor sleeping posture, and family history as significant predictors. Smoking emerged as the most prominent risk factor (OR = 2.5) [16]. Unlike the current research, which focused primarily on postural alignment and seating ergonomics, the Serbian study emphasized behavioral and hereditary influences. Together, these findings stress the importance of targeted preventive strategies addressing posture, ergonomics, and lifestyle choices. The current study revealed a strong association between poor sitting posture and back pain among university students, with a notable 56% experiencing mild and 24% moderate discomfort, particularly linked to classroom and home seating habits. Similarly, a 2025 investigation involving Australian physiotherapy students reported high lifetime (69%) and 12-month (63%) low back pain prevalence, with increased risk emerging after the first academic year, especially in those aged 20–21. While the Australian study emphasized prolonged academic exposure, clinical practice, and sustained forward-leaning postures as key contributors, the present research highlighted poor ergonomic support and suboptimal postural alignment [17]. Both studies demonstrated that extended periods of sitting, and academic strain significantly heighten the risk

DOI: https://doi.org/10.54393/tt.v5i03.253

of back pain. Moreover, age appeared as a contributing factor in both contexts. In the present study, a significant proportion of university students reported mild to moderate back pain, with poor sitting posture and inadequate ergonomic support identified as key contributing factors. Similarly, a 2022 cross-sectional study at Faridpur Medical College in Bangladesh found high 6-month (46.9%) and 12-month (63.3%) prevalence rates of low back pain among medical students, often linked to prolonged sitting, poor physical activity, and substandard seating conditions. Both studies observed higher prevalence in students exposed to extended sedentary periods and insufficient ergonomic arrangements. The Bangladeshi research further identified female gender and elevated BMI as significant risk factors [18]. While the current study did not focus on BMI or gender-based analysis, both investigations emphasized modifiable behaviors as primary drivers of LBP. Hoy *et al.*, highlight the high global prevalence and burden of nonspecific low back pain, emphasizing its significant impact on daily functioning and healthcare systems. Buchbinder et al., emphasize the urgent need for global action to address the rising burden of low back pain [19, 20].

CONCLUSIONS

This study demonstrated a significant association between sitting posture and low back pain among university students aged 18–25 years, who spent long hours sitting, with a majority seated on non-ergonomic chairs. Poor sitting posture was particularly common at home, with 76% of participants failing to maintain proper spinal alignment. A significant link emerged between classroom sitting posture and the severity of back pain, highlighting the need for improved posture. Additionally, an inverse relationship was noted between sitting posture quality and back pain levels. These findings underscore the importance of ergonomic interventions and awareness programs to reduce postural strain and associated musculoskeletal complaints.

Authors Contribution

Conceptualization: AZ, ST
Methodology: AZ, SS, ST, TA
Formal analysis: AZ, SS, ST, TA
Writing, review and editing: AZ, SS, ST, TA

All authors have read and agreed to the published version of the manuscript.

Conflicts of Interest

The authors declare no conflict of interest.

Source of Funding

The authors received no financial support for the research, authorship and/or publication of this article.

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DOI: https://doi.org/10.54393/tt.v5i03.253

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THE THERAPIST
JOURNAL OF THERAPIES & REHABILITATION SCIENCES
https://thetherapist.com.pk/index.php/tt
ISSN (P): 2790-7406, (E): 2790-7414
Volume 5, Issue 3 (July-Sep 2024)

Original Article

OPEN ACCESS

Prevalence of Anterior Cruciate Ligaments and Medial Cruciate Ligaments Injuries in Strikers in Football Players

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ARTICLE INFO

Keywords:
Cruciate Ligament, Football Strikers, Knee Injury Prevalence, Lysholm Knee Scoring Scale

How to Cite:
Javid, H., Liaqat, M., Tauqeer, S., & Ahmed, T. (2024). Prevalence of Anterior Cruciate Ligaments and Medial Cruciate Ligaments Injuries in Strikers in Football Players: Knee Ligament Injuries in Football Strikers. THE THERAPIST (Journal of Therapies &Amp; Rehabilitation Sciences), 5(03), 12-17. https://doi.org/10.54393/tt.v5i03.266

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Received Date: 27th July, 2024
Acceptance Date: 19th September, 2024
Published Date: 30th September, 2024

ABSTRACT

Stability of the knee is greatly supported in football by the Anterior Cruciate Ligament (ACL) and Medial Cruciate Ligament (MCL). Frequent changes in speed and direction, together with crashes, cause strikers to have increased chances of injuring their tendons and ligaments. **Objective:** To determine the prevalence of anterior cruciate ligaments and medial cruciate ligaments in strikers in football players. **Methods:** A cross-sectional study was carried out for four months across several teams of the 169 men, all were strikers, had least two years of playing experience and a past ACL or MCL injury. Lysholm Knee Scoring Scale used for assessment. SPSS version 26.0 was used for analysis of data. **Results:** Out of the 169 participants, 57.4% went through an ACL injury, and 38.5% had experienced MCL injury. A total of 63.3% of people had a slight/periodical limp, and 49.1% usually used canes or crutches for walking, as they reported. Out of all the participants, 51.5% scored below 65 in the Lysholm Knee Scoring, 37.9% scored between 65 and 83, 6.5% scored between 84 and 90, and only 4.1% scored above 91. 91.7% of patients displayed symptoms of the right knee. The majority of injuries happened in matches (61.5%), and most of those were semi-contact injuries (45.6%). **Conclusion:** The study showed that football strikers experienced ACL injuries in 57.4% of cases and MCL injuries in 38.5% of cases. Based on Lysholm scoring, 51.5% of the patients had knee function that was poor, and only 4.1% received excellent scores.

INTRODUCTION

The knee joint, a pivotal synovial hinge joint, plays an essential role in weight-bearing and complex locomotor activities, particularly in high-impact sports such as football [1]. The joint stabilized by ligaments as the Anterior Cruciate Ligament (ACL) prevents anterior translation of the tibia on the femur and controls rotational forces, while the Medial Cruciate Ligaments (MCL) resists valgus stress and provides medial stability [2]. Due to the rapid changes of direction, acceleration, deceleration, pivoting, and regular contact involved in football, these ligaments are particularly at risk for injury - especially the strikers due to the more explosive, aggressive demands of the position. Worldwide, ACL injuries happen annually to around 81.7 per 100,000 people, with most occurring during football primarily to males aged 20-49. In Pakistan there were limited understanding of the epidemiology, but studies indicate a higher prevalence of ACL and MCL injuries occurring due to greater participation in football and lack of opportunities to participate in appropriate training and rehabilitation. The MCL is the most common ligament injury of the knee and is symptomatic of injury to the ACL in 75-90% of instances. The MCL injuries also represented nearly 40% of all ligament injuries to the knee [3]. In football players, strikers that continuously kick the football, jump frequently, and crash into defenders during high-speed situations are more likely to experience ACL injuries [4]. The underlying causes of ACL and MCL injuries in football strikers can be broadly categorized into contact and non-

DOI: https://doi.org/10.54393/tt.v5i03.266

contact mechanisms. Non-contact injuries often occur due to sudden deceleration, pivoting, awkward landings, or changes in direction without external force. Contact injuries typically result from direct impact to the lateral or posterior knee during tackles [5, 6]. Additionally, the inadequate neuromuscular control, muscular imbalances, especially weak hamstrings in relation to quadriceps, fatigue, poor warm-up, poor core stability, poor footwear, and playing surfaces, especially hard or artificial turf [7]. Narrow intercondylar notch, valgus knee directionality, and generalized ligamentous laxity, and returning to play anxiety, may also affect biomechanics and susceptibility [8]. A clinical evaluation includes a thorough history with details about the circumstances of the injury, associated symptoms of a "pop," immediate swelling, feelings of instability, any functional limitations, effusion, range of motion loss, tenderness to palpation over the medial joint line [9]. During the physical examination a variety of special tests are used including the Lachman test and anterior drawer test to assess ACL integrity and a valgus stress test at 30 degrees of knee flexion for MCL testing Abreu *et al.*, in 2023 [10]. Magnetic Resonance Imaging (MRI) is the gold standard for detecting ligamentous injuries, revealing partial or complete tears, associated meniscal injuries, bone bruises, and other soft tissue damage [11, 12]. Management done conservatively with rest, ice, compression, elevation (RICE), Non-Steroidal Anti-Inflammatory Drugs (NSAIDs), functional bracing, and physiotherapy aimed at restoring joint stability, flexibility, and muscle strength [13]. Progressive loading exercises, proprioceptive training, and return-to-play protocols are essential components of non-operative care [14]. Hosseininejad *et al.*, in 2024 reported 70.9% had ACL tears in 285 subjects in which 79% had Noncontact ligament injury knee pivoting (54%) especially in military (63.9%) and sports (32.6%) activities [15]. Furthermore, Joshi *et al.*, in 2022 supported in 33.3% ACL injury was due to Sports activities Alqarni *et al.*, in 2022 mentioned 15 and 40 years athletes had years, revealing a prevalence of 14.7% [16, 17]. ACL injuries occurring on either artificial turf (44.7%) or dirt football fields (34%) as an important risk factor [17]. Szymski *et al.*, in 2022 supported the incidence of ACL injuries was highest in amateur football mostly associated with previous ACL injury (23.3%), prior knee injuries (19.3%) and stepping up in league (24.2%) [18]. Inclan *et al.*, in 2021 found an average of 66% of all ACL injuries accounted for with a variance depending on the position of the players: 86% in skill athletes, 72% in midskill athletes, and 61% in linemen [19]. Prior research has documented that Anterior Cruciate Ligament (ACL) injuries are one of the most prevalent musculoskeletal injuries in football players; strikers being the most commonly injured position (as a function of sport). However, a substantial literature gap exists with regards to the prevalence or pattern of knee injuries involving MCL injuries, in particular with respect to football strikers in Pakistan. In Therefore, this research aimed to investigate the prevalence of both ACL and MCL injuries among football strikers in Pakistan that may generate important information for position-specific needs in terms of injury prevention, management, and rehabilitation.

METHODS

The study used a descriptive cross-sectional study design following the University of Lahore Ethical Review Committee guidelines. Musculoskeletal injuries in football vary by player position and team dynamics. Murtaza *et al.*, in 2022 found positional differences in injury patterns between defenders and strikers [20]. Gupta *et al.*, in 2020 highlighted a high prevalence of knee injuries, particularly ACL tears, among football players [21]. Sandon *et al.*, in 2022 reported increased ACL injuries in teams undergoing coaching changes or moving to higher divisions [22]. Exclusion criteria were people with AIC pains, a non-ACL/MCL-involved knee injury, history of knee surgery, severe systemic medical illness, or mental illness, and active football obtaining participants [20, 22]. The participants were informed about the purpose and procedures involved in the study, signed informed consents and they were guaranteed that their identities will be withheld fully and not revealed anywhere. Data collection process was done through use of subjective and objective measures taken by a trained physiotherapist. Data were collected including age, favorite leg, number of hours of play per week and present occupation. Then the Lysholm Knee Scoring Scale (LKSS) was tasked to the participants. LKSS used for evaluating knee functioning. This assessment device has eight critical areas as limp, support, locking, instability, pain, swelling, stair climbing, and squatting. The ICC between 0.94 and 0.98 and Cronbach alpha of 0.71 and 0.73 indicate that it is a reliable and valid tool of evaluating the functional status in patients with ligamentous knee injuries [23]. After completion, the scores were summarized to evaluate prevalence and functional status of ACL and MCL injuries. SPSS version 26.0 was used to compute statistical data. The continuous variables like age were indicated in mean standard deviation and categorical variables were represented in frequencies and %ages.

RESULTS

The results shown in tabulated form. Table 1 shows demographic data as within the 169 male respondents enrolled in football, most (45.0%, n=76) fell in the age category of 18-24 years, 34.3% (n=58) had the age range of

DOI: https://doi.org/10.54393/tt.v5i03.266

25-30 years and 20.7% (n=35) had the age bracket of 31-35 years. Concerning the experience in football, 12.4 % (n=21) had played less than 1 year, 44.4 % (n=75) 1-3 years and 43.2 % (n=73) 3-5 years. Frequency of playing each week indicated that 0.6 % (n=1) never played, 18.3 % (n=31) played 1-2 times, 45.0 % (n=76) played 3-4 times, 16.6 % (n=28) played 5-6 times, and 19.5 % (n=33) played every day. The most commonly affected knee relationship was the right knee that contributed to 91.7% (n=155) of the participants with the left knee involvement recorded in 8.3 % (n=14). The occurrence of injury during matches stood at 61.5 (n=104) % and 38.5 (n=65) % during training. The most common injuries were semi-contact (45.6%, n=77) and full-contact (37.9%, n=64) and non-contact (16.6%, n=28). Regarding the time period out of play, 18.3% (n=31) were out of less than 1 month 45.0% (n=76) out of 1-3 months 17.2% (n=29) out of 3-6 months 19.5% (n=33) out of more than 6 months.

Table 1: Demographics Characteristic of Participants (n=169)

Variables	Category	Frequency (%)
Age	18-24	76 (45.0)
	25-30	58 (34.3)
	31-35	35 (20.7)
Gender	<1 year	21 (12.4)
	1-3 years	75 (44.4)
	3-5 years	73 (43.2)
Frequently play/week	0	1 (0.6)
	1-2 time	31 (18.3)
	3-4 time	76 (45.0)
	5-6 time	28 (16.6)
	daily	33 (19.5)
	Total	169 (100.0)
Affected Knee	Right	155 (91.7)
	Left	14 (8.3)
Event of injury	During match	104 (61.5)
	During training	65 (38.5)
Type of injury	Full contact	64 (37.9)
	Semi contact	77 (45.6)
	No contact	28 (16.6)
Duration out of play	< 1 month	31 (18.3)
	1-3 months	76 (45.0)
	3-6 months	29 (17.2)
	> 6 months	33 (19.5)

Table 2 shows the prevalence of injury as 57.4% of participants (n=97) had a history of anterior cruciate ligament (ACL) injury and 42.6 % of participants (n=72) had no history. Injuries of the medial cruciate ligament (MCL) were present in 38.5 % (n=65) of the respondents.

Table 2: Prevalence of Injury (n=169)

Variables	Category	Frequency (%)
ACL Injury	Yes	97 (57.4)
	No	72 (42.6)
MCL Injury	Yes	65 (38.5)
	No	104 (61.5)

Table 3 shows intensity of pain was measured using the right knee and 51.0% (n=79) had moderate pain with 38.7% (n=60) having high pain, 7.7% (n=12), mild pain, including 2.6% (n=4) with no pain. Of the sample showing left knee involvement (n=14), 57.1% (n=8) experienced moderate pain, 21.4% (n=3) severe pain, 7.1% (n=1) mild pain, and 14.3% (n=2) no pain.

Table 3: Specific Knee Pain among Participants

Affected Knee	Variables	Frequency (%)
Right Knee	Severe Pain (7-10)	60 (38.7)
	Moderate Pain (4-5)	79 (51.0)
	Mild Pain (1-3)	12 (7.7)
	No Pain (0)	4 (2.6)
	Total	155 (100.0)
Left Knee	Severe Pain (7-10)	3 (21.4)
	Moderate Pain (4-5)	8 (57.1)
	Mild Pain (1-3)	1 (7.1)
	No Pain (0)	2 (14.3)
	Total	14 (100.0)

According to Table 4, Lysholm Knee Scoring Scale (LKSS), 63.3% were having moderate or occasional limp, 21.3% were not having limp, and 15.4% had major and continuous limp. The use of assistive devices demonstrated that 49.1 % utilized crutches/canes, where there was partial load transference, 26.6 % used no assistance and 24.3 % utilized the affected leg. A lack of locking was reported by 23.7 % of participants, as was catching to an extent of 43.2 %, occasional locking (7.1 %), frequent locking (17.8 %), and locked now (8.3 %). On instability, 43.2 % said that their knee seldom yielded, 25.4 % reported knee give-way, and the rest had frequent knee give-ways either in physical (7.7 %) or daily (17.8 %) routines. The %age of participants experiencing pain during intense activities was 48.5%, 22.5% had no pain, and 28.9% reported the occurrence of marked pain. Post exercise swelling was evaluated in 50.9%, 23.1% reported general swelling, 15.4% were constancy swelling and 10.7% swelling after normal exercise. In stair climbing, most people experienced slight difficulty in climbing (43.2 %) with some experiencing no problem climbing (20.7 %), others managed to climb on the stairs once (18.9 %), and others were not able to climb (17.2 %). Among squatting, 36.1 of the respondents had mild difficulty, 30.2 of them were not able to squat more than 90 degrees, 11.8 people considered it to be impossible, and 21.9 did not have the problem. Lysholm final grade revealed

DOI: https://doi.org/10.54393/tt.v5i03.266

that 51.5 % (n=87) marked poor knee functioning (<65), 37.9 % (n=64) were graded as fair (65-83), 6.5 % (n=11) had good (84-90) and only 4.1 % (n=7) had an excellent score (91-100).

Table 4: Distribution of study participants according to Lysholm Scoring Scale

Variables	Category	Frequency (%)
Limp	I have no limp	36 (21.3)
	Slight/ periodical limp	107 (63.3)
	Severe and constant limp	26 (15.4)
Using cane or crutches	Don't use cane / crutchLKSS	45 (26.6)
	Use cane/ crutches with some weight bearing	83 (49.1)
	Putting weight on hurt leg	41 (24.3)
Locking sensation in the knee	No locking	40 (23.7)
	Catching sensation but no locking	73 (43.2)
	Locks occasionally	12 (7.1)
	Locks frequently	30 (17.8)
	Locks at this moment	14 (8.3)
Giving way sensation from the knee	knees give away	43 (25.4)
	Knees rarely give away	73 (43.2)
	Frequently give away during physical activities	13 (7.7)
	Frequently give away during daily activities	30 (17.8)
	Often give away during daily activities	10 (5.9)
Pain	No pain	38 (22.5)
	Slight pain during vigorous activities	82 (48.5)
	Marked pain during vigorous activities	11 (6.5)
	Marked pain during / after walking > 1 mile	25 (14.8)
	Marked pain during / after walking < 1 mile	13 (7.7)
Swelling	Swelling in knee	39 (23.1)
	Swelling after vigorous activities	86 (50.9)
	Swelling after ordinary activities	18 (10.7)
	Swelling constantly	26 (15.4)
Climbing stairs	No problem	35 (20.7)
	Slight problem	73 (43.2)
	Climb only one time	32 (18.9)
	Climbing is impossible	29 (17.2)
Squatting	No problem	37 (21.9)
	Slight problem	61 (36.1)
	Cannot squat beyond 90*	51 (30.2)
	Impossible squatting	20 (11.8)

DISCUSSION

The purpose of the present study was to investigate the prevalence of Anterior Cruciate Ligament (ACL) and Medial Cruciate Ligament (MCL) injuries in football strikers, with an emphasis on injury patterns and the associated risk factors. The findings indicate that 57.4% of participants experienced ACL injuries, while 38.5% sustained MCL injuries. These results underscore the high incidence of knee ligament injuries, particularly among strikers, who frequently engage in high-intensity maneuvers involving abrupt direction changes and physical contact, which contribute to the increased vulnerability of the ligaments. The higher incidence of ACL injuries observed in the current study aligns with prior research, including the study by Joshi *et al.*, in 2022, who found a 33.3% prevalence of ACL injuries among football players at a tertiary trauma center in Nepal [16]. This finding is additionally supported by findings of Gupta *et al.*, in 2020, who indicate a significant increased risk of ACL injuries with a 144-220 times increased risk in cutting, tackling, or pivoting sports, such as kabaddi and football [21]. Both articles have highlighted that football is a very dynamic sport that places a lot of load/strain on the ACL, hence increasing the risk of injury. The prevalence of MCL injuries in this study adds another piece to the puzzle of understanding knee ligament injuries. Although MCL injuries are less prevalent than ACL injuries, they remain clinically relevant, as demonstrated by the 38.5% prevalence rate found in this study. These findings were consistent with research conducted by Cristiani *et al.*, in 2024 who presented a lot of MCL findings in subjects that had tears in the ACL; however, MCL injuries were not the primary outcome, but rather a comparable outcome measure [24]. Here, the MCL finding adds to the current study explains the need for the data regarding MCL injuries when considering overall knee ligament injuries. This study's participants' mean age was 23.5 ± 4.8 years old, which is around the peak physical activity years of the football players. This finding aligns with Szymski *et al.*, in 2022, which reported that amateur football players sustained greater ACL injuries than professional players likely related to having access to varying amounts of training or training resources and injury prevention programs [18]. While ACL injury rates in professional sports by Palmieri-Smith *et al.*, in 2021 and Inclan *et al.*, in 2021 studies can be rather high for NFL players, elite football has different elements than other sports, and this presents uncertainty in drawing meaningful comparisons. (Including biomechanics, equipment, and turf) limit the applicability of these results to amateur football players [19, 25]. In the current investigation, injuries occurred most often during match play (61.5%), as semi-contact and full-contact instances also occurred often (with 45.6% doing semi-contact and 37.9% during full-contact play). The outcomes of this study are consistent with the research you find in the literature with Hosseininejad *et al.*, in 2024. For the investigation conducted by Hosseininejad *et al.*, in 2024, the authors identified that high-risk activities include rapid changes in direction and landing, which can quickly lead to ACL injuries with service personnel [15]. And with Schiffner *et al.*, in 2018, high intensity actions performed in matches were also confirmed to place elite soccer players at a greater risk of ACL ruptures [26]. The above investigations show that activities related to match play are important contributors

DOI: https://doi.org/10.54393/tt.v5i03.266

to the source of ACL injuries. This may be especially true for strikers that are often taking part in the periodic number of high-intensity, physical actions. The results of the current study add to the emerging literature that reveals ACL injuries as a significant issue within sports, particularly in football. Although ACL injuries are the most common injury to the knee while participating as a football striker, this study also emphasizes that MCL injuries, while common, are not always considered in the same light as ACL, highlighting a different injury risk. Having its own strength still study had some limitations. Initially, this research is that it employs a convenience sampling method, and thus the outcomes cannot be generalized to all football players in Pakistan. The participants were not chosen randomly thus the sample might not reflect players in various regions or competitive divisions as footballers. The second limitation is that injury history relied on self-reported information as opposed to a confirmed medical diagnosis or imaging e.g., MRI. Based on these limitations, future researches are encouraged to consider implementing a better sampling, like random or stratified sampling, so that a more comprehensive representation is captured in different regions and in different playing levels across Pakistan. Moreover, the addition of female athletes and those representing other types of sports might provide a broader look at the pattern of ACL and MCL injuries regarding gender and athletic type, which would eventually be applied to more diverse and efficient injury prevention practices.

CONCLUSIONS

The study concluded that ligament injuries were highly prevalent in footballer as 57.4% of football strikers experienced injuries to the anterior cruciate ligament and 38.5% experienced injuries to the medial cruciate ligament. In addition, 51.5% experienced weak and poor knee function (Lysholm score < 65), whereas only a 4.1% achieved an exceptional knee result (91–100).

Authors Contribution

Conceptualization: HJ, ML
Methodology: ML, ST, TA
Formal analysis: ML, ST, TA
Writing, review and editing: ML, ST, TA

All authors have read and agreed to the published version of the manuscript.

Conflicts of Interest

All the authors declare no conflict of interest.

Source of Funding

The authors received no financial support for the research, authorship and/or publication of this article.

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THE THERAPIST
JOURNAL OF THERAPIES & REHABILITATION SCIENCES
https://thetherapist.com.pk/index.php/tt
ISSN (P): 2790-7406, (E): 2790-7414
Volume 5, Issue 3 (July-Sep 2024)

Original Article

OPEN ACCESS

Prevalence of Pes Planus and Pes Cavus in School Going Children

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ARTICLE INFO

Keywords:
Pes Planus, Pes Cavus, Footprint Analysis, Foot Deformities

How to Cite:
Qasim, M., Rauf, W., Toqueer, S., Ahmed, T., & Sukhera, S. (2024). Prevalence of Pes Planus and Pes Cavus in School Going Children: Foot Arch Disorders Prevalence. THE THERAPIST (Journal of Therapies &Amp; Rehabilitation Sciences), 5(03), 18-22. https://doi.org/10.54393/tt.v5i03.258

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Received Date: 24th July, 2024
Acceptance Date: 24th September, 2024
Published Date: 30th September, 2024

ABSTRACT

Pes planus and pes cavus are common foot deformities that may affect a child's posture and mobility. **Objective:** To investigate the incidence of idiopathic pes planus and pes cavus among school-going children with no known neurological or anatomical irregularities and without any known systemic diseases. **Methods:** This descriptive cross-sectional study was conducted on 75 school-going children aged 5 to 12 years in Lahore, using a convenient sampling technique. Data were collected through structured footprint analysis and a demographic questionnaire. Footprints were obtained using the ink method and analyzed using Staheli's Index to classify foot types as normal, pes planus, or pes cavus. Children with neurological disorders, foot deformities, systemic diseases, or a history of lower limb surgeries were excluded. Data were collected using SPSS version 26.0. **Results:** A total of 75 school-going children participated in the study, with a mean age of 9.35 ± 1.90 years. About half of the participants (52%) reported engaging in physical activity. Sandals were the most commonly worn footwear (34.7%), followed by barefoot walking (24%). A positive family history of foot conditions was reported by 56%, and 46.7% experienced foot pain. Foot type analysis showed that the majority had normal arches (64% both feet), with pes cavus more prevalent on the right foot (33.3%) than pes planus (2.7%). On the left foot, pes cavus and pes planus were observed in 25.3% and 10.7%, respectively. **Conclusion:** Pes cavus was more prevalent than pes planus, especially in the right foot, though overall rates were low.

INTRODUCTION

Foot deformities are a significant concern in musculoskeletal health, affecting individuals of all ages and often leading to mobility issues, pain, and long-term complications if left untreated [1]. Among the most common deformities are pes cavus and pes planus, which represent opposite abnormalities in foot structure and function [2]. Pes cavus, characterized by an excessively high medial longitudinal arch, is often linked to underlying neurological disorders, particularly in children and adolescents [3, 4]. This deformity alters foot biomechanics, leading to instability, increased risk of ankle sprains, and difficulties with weight distribution, ultimately affecting gait and overall mobility [5]. The most clinically significant form, pes cavovarus, frequently occurs in individuals with neurological conditions such as Charcot-Marie-Tooth (CMT) disease, cerebral palsy, or Friedreich's ataxia, and tends to worsen over time, causing functional impairment and pain. Early detection and intervention are critical in managing this condition effectively and preventing further musculoskeletal complications [4]. Pes cavus is a foot deformity characterized by an abnormally high longitudinal arch. While it may be a benign anatomical variant, it often signifies an underlying neurological disorder, particularly in children and adolescents [6]. Identifying the condition early is essential, as progressive forms can lead to pain, instability, and long-term functional impairment. Among its various forms, pes cavovarus is the most common and is frequently associated with neurological conditions such as Charcot-Marie-Tooth disease (CMT) [7]. The foot functions as a tripod, distributing weight among the heel, first metatarsal, and fifth metatarsal. A pes cavus deformity

DOI: https://doi.org/10.54393/tt.v5i03.258

arises when these points shift, causing an exaggerated arch. This condition can be either rigid or flexible, affecting the foot's biomechanics across multiple planes [8]. Pes cavus is described as a medial longitudinal arch that is too high. Although it may be linked to issues of a neuromuscular disorder, idiopathic cavus foot in most children is actually idiopathic without pathology. It can cause the gait to change, result in high foot pressure, and cause discomfort of the posture. Establishing its prevalence among school going children is relevant to screen its prevalence early and offer preventive medicineFoot type analysis revealed that 64% had normal arches on both feet, while pes cavus (25.33%) was more prevalent than pes planus (2.7%), especially on the right foot [9]. In many cases, both forms coexist, creating a mixed presentation. Among these, pes cavovarus is the most clinically significant, characterized by a high arch, clawing of the toes, forefoot pronation, and a varus (inward-tilted) position of the heel. This particular form is often linked to neuromuscular disorders and tends to worsen over time if left untreated [10]. The exact prevalence of pes cavus remains unclear, though studies suggest it affects about 2% of children by age three and increases to around 7% by adolescence. In adults, the prevalence ranges between 10.5% and 25% [11]. While some cases are idiopathic with no apparent cause, many arise due to an underlying neurological, muscular, or orthopedic condition. Among neurological causes, peripheral neuropathies such as CMT are the most common. This hereditary condition leads to progressive nerve degeneration, resulting in muscle weakness and foot deformities, including pes cavus [12]. Other neurological conditions such as cerebral palsy, Friedrich's ataxia, and spinal cord anomalies like syringomyelia or tethered cord syndrome may also contribute to the development of cavus foot [13]. Non-neurological causes include congenital anomalies, post-traumatic changes, and vascular issues that alter normal foot development. When the condition is unilateral, spinal abnormalities must be carefully considered as potential causes [14]. Abnormal foot arches, such as pes planus (flat feet) and pes cavus (high arches), can affect posture, balance, and overall musculoskeletal health in children.

The study aimed to determine the prevalence of pes planus and pes cavus in school-going children.

METHODS

This study employed a descriptive cross-sectional design. A total of 75 school-going children aged 5 to 12 years were recruited through convenience sampling from selected schools in Lahore. Online sample size calculator was used to calculate the sample size. The footprint study utilized the ink method, where each participant was asked to step onto an inked pad and then place their foot on white A4 paper while standing on a stable wooden platform to ensure proper weight distribution. This process was repeated for both feet. The collected footprints were analyzed to determine the plantar arch index using Staheli's Index, which classified foot types into normal, pes planus, or pes cavus. Additionally, a demographic questionnaire was used to gather information such as age, gender, BMI, and history of foot pain. The collected data were recorded systematically and were later analyzed statistically to assess the prevalence of different foot types among school-going children [15]. The criteria of inclusion included school children of the age between 5-12 years and children who could stand up and obey simple instructions. Children with any diagnosed musculoskeletal or neurological abnormalities (e.g., cerebral palsy or CharcotMarieTooth disease), congenital foot deformities, systemic disease, recent foot or lower limbs injury or a history of lower limb surgery were excluded in the study. To reduce confounding effects and to make sure that only idiopathic cases of pes planus and pes cavus should take part in the analysis, these criteria were put to work. Participants' responses were collected, and all data were entered into an SPSS file. The data were analyzed using SPSS version 26.0 and interpreted to derive further results. Descriptive statistics of categorical data, such as frequency, percentage, cross-tabulation, bar charts, and pie charts, were used to represent variables. For non-categorical (continuous) data, (mean, median), dispersion (standard deviation, range), and histograms were used to summarize and interpret the data.

RESULTS

Data were collected from 75 valid responses, with no missing values. The mean age was 9.35 ± 1.90 years, indicating that most participants were around 10 years old, with a moderate variation. The minimum and maximum ages recorded were 5 and 10 years, respectively (Table 1).

Table 1: Descriptive Statistics of Age (n=75)

Variables	Value
Mean ± SD	9.35 ± 1.899
Minimum	5
Maximum	10

Out of 75 individuals, 46 were female (61.3%) and 29 were male (38.7%). The data showed a higher proportion of female participants compared to males (Figure 1).

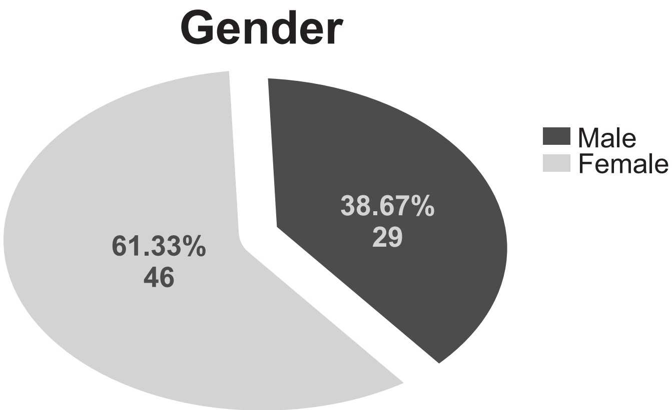

Figure 1: Graphical Representation of Gender (n=75)

Out of 75 valid responses, 35 participants (46.7%) reported experiencing foot pain, while 40 participants (53.3%) did not. This indicates that nearly half of the participants experienced some form of foot pain (Table 2).

Table 2: Descriptive Statistics of Foot Pain (n=75)

Response	Frequency (%)
Yes	35 (46.7)
No	40 (53.3)
Total	75 (100.0)

The mean Right Staheli Index was 0.5389 ± 0.1851, indicating a moderately arched foot on average. The values ranged from 0.23 to 0.93, reflecting a variation from high arches (pes cavus) to low arches (pes planus) among participants (Table 3).

Table 3: Descriptive Statistics of Right Staheli Index (n=75)

Variables	Value
Mean ± SD	0.5389 ± 0.1851
Minimum	0.23
Maximum	0.93

Out of 75 valid responses, 48 participants (64.0%) were classified as having a normal foot type. Pes cavus was observed in 25 participants (33.3%), while pes planus was the least common, seen in only 2 participants (2.7%). This indicates that the majority of participants had normal right foot arches, with a significant portion exhibiting a high arch (pes cavus)(Table 4).

Table 4: Descriptive Statistics of Right Foot type (n=75)

Foot Type	Frequency (%)
Normal	48 (64.0)
Pes Planus	2 (2.7)
Pes Cavus	25 (33.3)
Total	75 (100.0)

All 75 entries were valid with no missing data. The mean Left Staheli Index was 0.605 ± 0.219, with values ranging from a minimum of 0.18 to a maximum of 0.99, indicating variation in the plantar arch characteristics of the participants' left feet.

Table 5: Descriptive Statistics of Left Staheli Index (n=75)

Variables	Value
Mean	0.6049 ± 0.2193
Minimum	0.18
Maximum	0.99

DISCUSSION

The objective of this study is to determine the prevalence of pes planus and pes cavus in school going children. In this study of 75 school-going children (mean age 10.35 years), most participants were female (61.3%) and underweight (76%). About 52% engaged in physical activity, and sandals were the most commonly worn footwear. Foot type analysis revealed that 64% had normal arches on both feet, while pes cavus (25.33%) was more prevalent than pes planus (2.7%), especially on the right foot. The prevalence of pes cavus has been observed to be high (in right foot 33.3%, in left foot 25.3), which is far much higher accompanied compared to other reports in the pediatric literature where estimates put prevalence of idiopathic cases between 2-7 percent. This inconsistency can be explained by methodological drawbacks like application of Staheli Index without age-related normative curves, possible misinterpretation of high arches in growing feet, application of small, non-random sample. Although, due to the lack of clinical confirmation, these could have been overestimated considering only the analysis of static footprints. Current study results had resembled with previous study by Kharbuja and Dhungel, normal foot arch type was found to be more prevalent 64% on the right and 64% on the left foot. Prevalence of pes planus recorded was relatively less than pes cavus [15]. Such decreased incidence of flat foot in this study in comparison to the studies made in western countries (15%) could be because of children not wearing shoes. Almost same results had found in current study in which pes cavus is more prevalent than pes plenus and mostly seen in right foot [16]. Another study examined how different foot postures normal, planus, and cavus affect foot movement patterns during walking [17]. Although the prevalence of pes cavus in the right foot was a bit higher, this is of incident nature. In normal persons, the gait examinations always show an even weight distribution between the legs. Consequently, lateral asymmetry results are more likely caused by methodological diversity, measurement bias or differences in sample than a real biomechanical difference in loading therefore, it might have been more prone to develop foot deformity [18]. The findings of our study regarding the prevalence of foot deformities align with previous research, which reported a notable occurrence of pes planus and pes cavus in southern populations and

DOI: https://doi.org/10.54393/tt.v5i03.258

identified similar prevalence and associated factors among school-aged children in Ethiopia [19, 20].

CONCLUSIONS

This study highlighted a higher prevalence of pes cavus (25.3%) compared to pes planus (2.7%) among school-going children in Bhaktapur, with a notable dominance on the right foot. The findings contrast with global pediatric literature, likely due to methodological limitations such as small, non-random sampling, reliance on the Staheli Index without age-specific norms, and absence of clinical confirmation. Cultural practices, including walking barefoot and wearing sandals, may influence arch development. The relatively low incidence of flatfoot and higher cavus prevalence suggest the need for standardized, clinically validated assessment tools and larger, randomized studies to draw more accurate conclusions about pediatric foot morphology in this region.

Authors Contribution

Conceptualization: MQ
Methodology: WR, ST, TA, SS
Formal analysis: WR, ST, TA, SS
Writing, review and editing: WR, ST, TA, SS

All authors have read and agreed to the published version of the manuscript.

Conflicts of Interest

All the authors declare no conflict of interest.

Source of Funding

The authors received no financial support for the research, authorship and/or publication of this article.

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THE THERAPIST
JOURNAL OF THERAPIES & REHABILITATION SCIENCES
https://thetherapist.com.pk/index.php/tt
ISSN (P): 2790-7406, (E): 2790-7414
Volume 5, Issue 3 (July-Sep 2024)

Original Article

OPEN ACCESS

Assessment of Foot Pronation and Lower Limb Injuries Among Recreational Runners: A Cross-Sectional Study

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ARTICLE INFO

Keywords:
Foot Pronation, Lower Limb Injuries, Recreational Runners, Foot Posture Index

How to Cite:
Umer, A., Sukhera, S., Ahmed, T., Younas, R. M. A., & Qasim, M. (2024). Assessment of Foot Pronation and Lower Limb Injuries Among Recreational Runners: A Cross-Sectional Study: Foot Pronation and Injuries. THE THERAPIST (Journal of Therapies &Amp; Rehabilitation Sciences), 5(03), 23-28. https://doi.org/10.54393/tt.v5i03.260

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Received Date: 24th June, 2024
Acceptance Date: 26th September, 2024
Published Date: 30th September, 2024

ABSTRACT

Recreational runners may be at risk for lower limb injuries due to foot pronation. **Objective**: To assess the association between foot pronation and lower limb injuries in recreational runners. **Methods:** A cross-sectional analytical study was conducted on 142 recreational runners (both sexes, aged >18) who ran at least three times weekly. Individuals with walking impairments or undergoing rehabilitation were excluded. Ethical approval was obtained, and informed consent was collected. Post-hoc power analysis confirmed 82% power ($\alpha = 0.05$, Cohen's $h = 0.3$) for chi-square testing. Foot posture was assessed using the Foot Posture Index (FPI), and foot mobility via the Sit-to-Stand Navicular Drop Test (SSNDT). Lower limb function was evaluated using the Lower Extremity Functional Scale (LEFS). Statistical analysis was performed using SPSS version 28.0. Descriptive statistics summarized participant data. Chi-square and Fisher's exact tests assessed injury prevalence across foot posture categories. T-tests or Mann-Whitney U tests compared navicular drop and LEFS scores between injured and non-injured groups. Logistic regression analyzed associations between FPI scores and injury risk, adjusting for BMI and age. **Results:** Most participants were young adults, with more females. Common injuries involved the groin (52.8%), knee (54.9%), and ankle (ligamentous: 56.3%; non-ligamentous: 49.3%). Pronated feet were found in 38.7% of runners. Mean FPI score was 5.04 ± 3.67; navicular drop was 11.31 ± 3.66 mm. Mean LEFS score was 42.61 ± 20.39. **Conclusion:** Foot pronation is significantly associated with lower limb injuries. Clinical tools like FPI and SSNDT are effective for identifying at-risk individuals.

INTRODUCTION

Running is a popular sport all over the world that is well known for its health advantages. But it's also regarded as a physically taxing activity that calls for a great deal of endurance, especially from the structures that support the morphology of the foot [1]. Numerous musculoskeletal ailments, including as fasciitis, ankle sprains, knee pain, and low back pain, have been linked to foot hyperpronation, which is defined by an abnormal inward rolling of the foot [2]. The foot's Medial Longitudinal Arch (MLA), which is actively supported by the foot muscle and passively maintained by the bone and ligamentous structures, is essential to preserving the foot's structure [3]. Running-related foot issues are thought to affect 85% of runners annually [4]. Running has been thought to put people with misaligned feet at higher risk for foot injuries [5]. Because of their intricate anatomy, the ankle and foot the farthest limbs on the human body are essential for keeping the body upright while it is in touch with the ground [6]. The arch formed by the foot's bones serves a variety of purposes, such as propulsion, stability, flexibility, energy production, weight distribution support, and joint surface protection for the knees, ankles, and feet [7]. One common issue that can have a big impact on running biomechanics is foot hyperpronation [8]. The risk of lower limb injuries is increased by this excessive pronation, which frequently results in impaired foot function [9]. People with hyperpronation are more likely to sustain ailments including plantar fasciitis, ankle sprains, and knee pain when they run recreationally [10]. The significance of identifying risk variables for injury prevention is highlighted

DOI: https://doi.org/10.54393/tt.v5i03.260

by the fact that factors including excess body weight, muscle exhaustion, and inappropriate running styles all lead to an increased frequency of injuries [11]. Excessive foot pronation and the higher risk of musculoskeletal problems in runners are caused by a number of risk factors [12]. Muscle exhaustion brought on by prolonged running might cause or exacerbate foot pronation [13]. Overweight and obese people are more likely to experience increased strain on their lower limbs, which can change their running mechanics and increase their risk of injury [14]. The development of ailments such low back pain, tibial stress syndrome, and patellofemoral discomfort is significantly influenced by foot malalignment, especially severe foot pronation [15]. Inappropriate running methods, such as overstriding or inadequate support, can also increase the risk of foot pronation-related injuries [16]. The foot and lower limb mechanics are changed by this pronation, which puts more strain on joints like the knees, hips, and lower back [17]. The higher mechanical load increases the risk of damage in people who are overweight [18]. Interventions like focused strengthening exercises and appropriate running technique can help lower injury risks and improve running performance by recognizing the connection between muscle fatigue, foot pronation, and injury development [19]. Foot posture abnormalities, including pes planus (flat foot) and pes cavus (high-arched foot), are known to be intrinsic risk factors for injuries to the lower limbs [20]. Foot posture often referred to as foot type in the literature—contributes to injury vulnerability by affecting lower extremity motion [21]. Compared to people with pes cavus, people with pes planus typically have more foot movement [22]. Accordingly, research on people with pes planus who run or walk has shown that they are more vulnerable to tissue stress injuries because of aberrant joint rotation or coupling [23]. Foot pronation at the subtalar joint is important for functional functions such body propulsion and shock absorption during the active periods of walking [24]. Due to increased torques on the lower extremities and greater medial tibial rotation, severe foot hyperpronation is linked to an increased risk of injury [25]. This has long been thought to be the main cause of many kinds of injuries to the lower limbs. Running athletes' posture and balance can be affected by foot pronation, which can affect their performance as a whole [26]. Changes in lower limb alignment, including increased subtalar pronation, tibial internal torsion, internal rotation of the tibia, greater knee hyperextension (genu recurvatum), anterior knee laxity, forward pelvic tilt (anteversion), and curvature of the lower spine (lumbar lordosis), are linked to a decrease in the height of the Medial Longitudinal Arch (MLA) [27]. A prevalent condition among runners, foot pronation has been connected to a number of lower limb issues. On the other hand, little was known about the precise connection between recreational runners' injury risk and foot pronation. There was a substantial research gap regarding leisure runners, who frequently displayed a range of training intensities and injury patterns, even though many studies had examined this association in elite athletes.

In order to fill this knowledge gap, this study evaluated foot pronation and its relationship to lower limb injuries in recreational runners.

METHODS

A practical sample technique was used to do a cross-sectional analytical research from February 2024- May 2024 on 142 recreational runners. The University of Lahore in Lahore provided the statistics in four months. Prior to data collection, ethical approval was acquired, and each participant's informed consent was obtained. Particular inclusion and exclusion criteria were used in the selection of participants. Males and females between the ages of 18 and 45 who willingly agreed to participate met the inclusion criteria. Healthy recreational runners between the ages of 18 and 45 who run at least three times a week for at least an hour were eligible, regardless of their foot position. Individuals who were pregnant, receiving ongoing rehabilitation treatment, having alterations or deformities that could interfere with normal walking, refusing to give informed consent, or experiencing pain in any part of their body that could affect the navicular drop test such as pain when getting out of a chair were all excluded. The Foot Posture Index (FPI) and the Sit-to-Stand Navicular Drop Test (SSNDT) were used in this cross-sectional analytical study to evaluate foot pronation and its relationship to lower limb injuries in recreational runners. During the FPI evaluation, participants' foot position was categorized using six criteria were assessed by the examiner: talus palpation, medial longitudinal arch congruence, calcaneus location in the frontal plane, talo-scaphoid prominence, inframalleolar and supramalleolar curvature, and forefoot adduction or abduction. The overall score ranged from -12 to +12, with each criterion receiving a score between -2 and +2. Pronation was indicated by a score over +6, supination by a score below -6, and neutral foot posture by a score between -5 and +5. Each foot of this operation took about two minutes [22].

RESULTS

The majority of the 142 participants (40.1%) were between the ages of 23 and 27, followed by those between the ages of 18 and 22 (35.2%), according to the descriptive statistics of the study variables. Sixty-six percent of the sample was female. The participants' weights ranged from 47.10 to 100 kilograms, with an average of 72.74 ± 12.82 kilos, while their

DOI: https://doi.org/10.54393/tt.v5i03.260

heights ranged from 1.55 to 1.85 meters, with a mean of 1.69 ± 0.089 meters. According to BMI, 61.3% of participants were overweight (BMI 25.0–29.9), while 38.7% were considered normal weight (BMI 18.5-24.9). With 52.8% of participants reporting groin injuries, 45.8% reporting quadriceps injuries, 44.4% reporting hamstring injuries, 54.9% reporting knee injuries, 56.3% reporting ligamentous ankle injuries, and 49.3% reporting non-ligamentous ankle injuries, the injury prevalence was significant. The Foot Posture Index ranged from 4 to 10, with an average of 5.04 ± 3.67 and a mean score of 11.31 ± 3.66 mm for the Navicular Drop Test. 43.0% of people had normal foot posture, 38.7% had pronated feet, 12.0% had highly pronated feet, and 6.3% had supinated feet. Lastly, the Lower Extremity Functional Scale scores ranged from 6 to 74, with a mean of 42.61 ± 20.39, reflecting variability in lower limb function within the sample. Bar chart summary showing most respondents aged 23–27 years (40.1%), majority female (60.6%), and 61.3% classified as overweight (Table 1).

Table 1: Qualitative Statistics of Age (n=142)

Variables		Frequency (%)
Age	18-22 Years	50 (35.2)
	23-27 Years	57 (40.1)
	28-31 Years	29 (20.4)
	32-35 Years	6 (4.2)
Gender	Male	56 (39.4)
	Female	86 (60.6)
BMI	Normal	55 (38.7)
	Overweight	87 (61.3)

Bar chart showed the age distribution of respondents, with the highest frequency in the 23–27 years group (Figure 1).

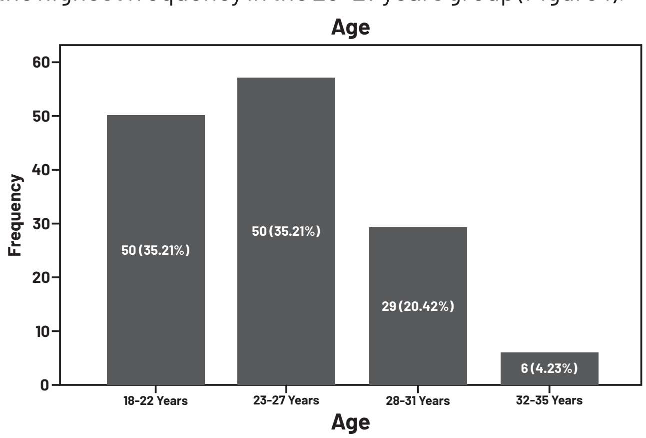

Figure 1: Age Distribution of Respondents

Bar chart showing the BMI distribution of respondents, with 61.27% overweight and 38.73% normal (Figure 2).

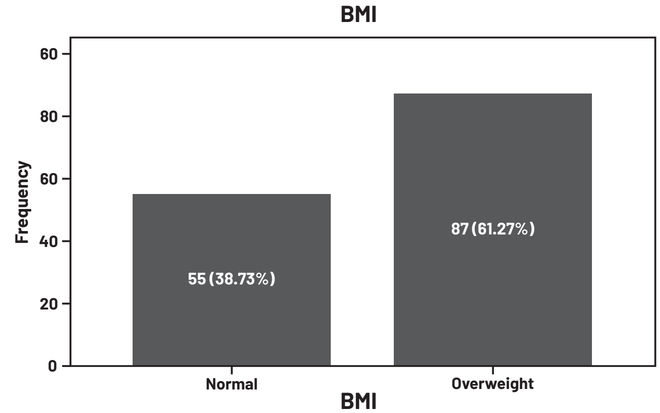

Figure 2: BMI Distribution of Respondents

Table 2 summarizes the prevalence of injuries and range of physical assessment scores among respondents.

Table 2: Prevalence of Injuries and Physical Assessment Measures Among Respondents

Variables		Frequency (%)
Groin Injury	Absent	67 (47.2)
	Present	75 (52.8)
Quadricep injury	Absent	77 (54.2)
	Present	65 (45.8)
Hamstring Injury	Absent	79 (55.3)
	Present	63 (44.6)
Knee Injury (Ligamentous)	Absent	64 (45.1)
	Present	78 (54.9)
Ankle Injury	Absent	62 (43.7)
	Present	80 (56.3)
Ankle Injury (non-Ligamentous)	Absent	70 (49.2)
	Present	72 (50.2)
Navicular drop test	Min	1.49
	Max	15
Foot posture index	Min	4
	Max	10
LEFS	Min	6
	Max	74

Prevalence of Injuries and Physical Assessment Scores Among Respondents (Figure 3).

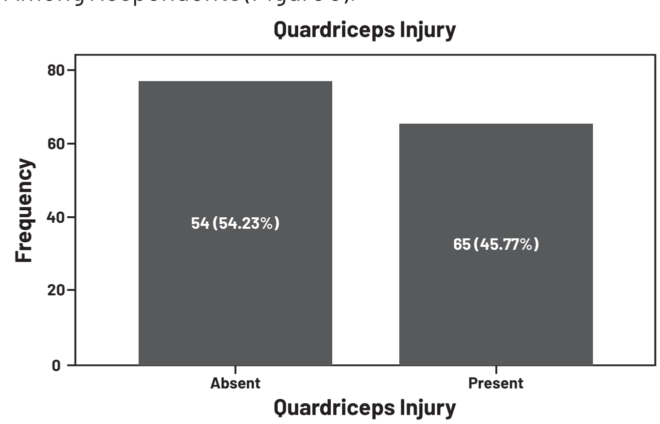

Figure 3: Prevalence of Quadriceps Injury Among Respondents

DOI: https://doi.org/10.54393/tt.v5i03.260

Bar chart showing that groin injury was present in 52.8% of respondents and absent in 47.2% (Figure 4).

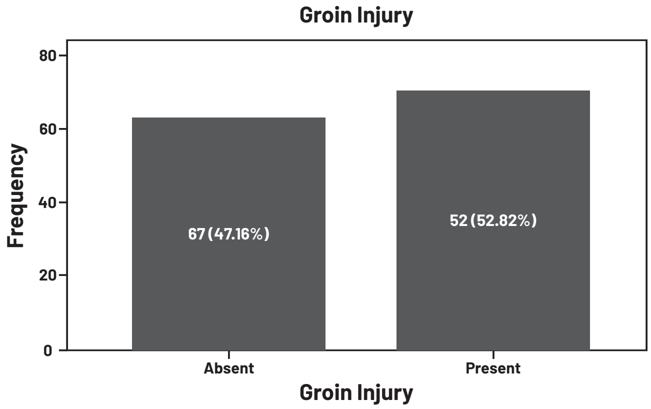

Figure 4: Prevalence of Groin Injury among Respondents

DISCUSSION

A notable incidence of lower limb the current study was conducted on recreational runners at the University of Lahore and found injuries, particularly in the groin, knee, and ankle regions. This is consistent with previous Brazilian studies that found injury rates ranging from 37% to 65.9%. This range and the current findings are supported by the Brazilian study's injury prevalence of 58.5%, which indicates that most populations have high rates of musculoskeletal injuries among recreational runners [28]. Sports injury research is quite challenging since various people have varied ideas about what constitutes an injury. Previous research has defined injury as self-reported incidents that result in decreased training capacity or as musculoskeletal pain that limits running for at least one week. The current study, on the other hand, used a more expansive definition, taking into account any lower limb pain or injury that restricted or eliminated training or competition participation for a minimum of one day [29]. The variation in injury prevalence reported between studies may be partially explained by this disparity in injury criteria. The more inclusive injury criteria used in this study, along with standardized evaluation instruments such as the Lower Extremity Functional Scale, Foot Posture Index, and Navicular Drop Test, improve the consistency and comparability of results and aid in resolving methodological discrepancies that have historically made injury research challenging [30]. According to demographics recorded in prior research, the majority of amateur runners in the previous study were male, primarily between the ages of 30 and 40, with an average age of 38.6, and had more than five years of running experience. According to a study, injury incidence was not significantly correlated with age or running experience. This is supported by evidence from recent assessments suggesting these parameters have minimal impact on injury risk [31]. The majority of amateur runners in the previous study were male, mainly between the ages of 30 and 40, with an average age of 38.6, and had more than five years of running experience, in accordance with demographics documented in other studies. A study found no significant correlation between injury occurrence with running experience or age. This is supported by data from recent assessments that indicate these characteristics have minimal impact on injury risk. While some research suggests gender-specific risk profiles, with younger male runners at higher risk, lower running experience increases the risk of injury for both sexes. These findings highlight the complexity of injury risk variables and suggest that demographic factors may not be enough to explain trends in injuries among recreational runners [32]. The majority of participants (60.6%) are female, and 40.1% are between the ages of 23 and 27, per the descriptive statistics of the current study. The injury prevalence was significant in a number of lower limb regions, such as the groin (52.8%), knee (54.9%), and ankle (up to 56.3%), which is consistent with other studies that demonstrate a high frequency of musculoskeletal injuries among recreational runners. More than half of individuals had some degree of pronation, according to assessments of foot posture (38.7% were pronated, and 12% were highly pronated), which is in line with established links between foot mechanics and injury risk. The Lower Extremity Functional Scale, which measures functional ability, revealed significant diversity, reflecting the various ways that injuries affect lower limb performance [33, 34].

CONCLUSIONS

Recreational runners frequently exhibit foot pronation, which is linked to an increased risk of lower limb injuries, especially those affecting the groin, knee, and ankle. Abnormal foot posture and greater foot mobility, which may increase the risk of injury, were successfully identified using the Foot Posture Index and the Sit-to-Stand Navicular Drop Test. Additionally, variations in lower limb function, as measured by the Lower Extremity Furthermore, the influence of foot posture on overall functional performance is highlighted by differences in lower limb function as assessed by the Lower Extremity Functional Scale. External factors such as footwear type, running surface, and training intensity were not accounted for, which may have influenced injury patterns.

Authors Contribution

Conceptualization: SS
Methodology: AU, TA, RMAY, MQ
Formal analysis: AU, TA, RMAY, MQ
Writing, review and editing: AU, TA, RMAY, MQ

DOI: https://doi.org/10.54393/tt.v5i03.260

All authors have read and agreed to the published version of the manuscript

Conflicts of Interest

The authors declare no conflict of interest.

Source of Funding

The authors received no financial support for the research, authorship and/or publication of this article.

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