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PREVALENCE AND RISK FACTORS IN THE DEVELOPMENT OF MEDIAL TIBIAL STRESS SYNDROME AMONG PROFESSIONAL RUNNERS OF PESHAWAR

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Keywords
including strength and flexibility training, biomechanical correction, and optimized running surfaces, are recommended to mitigate the impact of MTSS on professional runners.

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Abstract
Medial Tibial Stress Syndrome (MTSS), commonly known as "shin splints," is a prevalent lower extremity injury, especially among runners. This study investigates the prevalence and associated risk factors of MTSS among professional runners in Peshawar, Pakistan. Conducted at Qayyum and Hayatabad Sports Complexes, the cross-sectional study involved 46 participants, both male and female, aged 15 to 40 years. The results revealed that 41.30% of the participants experienced MTSS. Notable risk factors included reduced calf girth, decreased ankle dorsiflexion, higher Foot Posture Index (FPI-6) scores, and training on hard surfaces such as roads. Additionally, abnormal biomechanical variables, such as limited range of motion (ROM) in the hip, knee, and ankle joints, were significantly associated with MTSS. The findings underscore the importance of addressing modifiable risk factors such as muscle strength, flexibility, and training conditions to reduce MTSS prevalence in professional athletes.

INTRODUCTION
Medial Tibial Stress Syndrome (MTSS), commonly known as shin splints, is one of the most frequent overuse injuries
observed in athletes, particularly runners. MTSS is characterized by pain along the posteromedial border of the tibia, affecting the lower leg and can severely impair athletic performance. According to recent studies, MTSS affects a significant percentage of runners globally, with rates of prevalence varying from country to country. This study investigates the prevalence of MTSS among professional runners in Peshawar, Pakistan, and identifies the major risk factors that contribute to the development of this injury.

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Background and Literature Review

MTSS has a historical context dating back to the first description of the condition in 1942 by Devas, who attributed it to excessive strain on the periosteum, the thin membrane covering the tibia. The pain and inflammation caused by MTSS are often triggered by repetitive impact activities like running, which puts immense stress on the tibial region.

Various international studies highlight the prevalence of MTSS among athletes and military recruits. In the United States, the prevalence of MTSS has been reported between 4% and 35% among military recruits, and in other countries like the UK, Canada, Germany, and China, similar findings have been recorded.

In Pakistan, the prevalence of MTSS is not widely studied, though previous research among military cadets and recreational runners indicates that the condition affects a considerable portion of the population engaged in high- impact physical activities.

Object ves

The primary objective of this study is to determine the prevalence of MTSS among professional runners in Peshawar. The secondary objective is to identify the risk factors associated with the development of MTSS, including anthropometric, exercise-related, and biomechanical factors.

Methodology

This cross-sectional study was conducted at two major sports complexes in Peshawar: Qayyum Sports Complex and Hayatabad Sports Complex. The sample size consisted of 57 registered professional runners, out of which 46 met the inclusion criteria.

The inclusion criteria involved male and female runners aged between 15 and 40 who had been running for a minimum of one year.

Data collection involved measuring demographic, anthropometric, and exercise-related data such as age, BMI, hip-to-waist ratio, calf girth, running surface, and weekly running hours.

Biomechanical assessments included hip, knee, and ankle range of motion (ROM) along with foot posture analysis using the Foot Posture Index (FPI-6).

The presence of MTSS was confirmed based on specific criteria like pain history, location, and palpation.

Results

Prevalence of MTSS

The study found that 41.30% of the professional runners in Peshawar were affected by MTSS. This is comparable to global findings, indicating that MTSS is a significant concern in regions with active sports populations. The study's findings also indicate that the prevalence is higher in runners who train on hard surfaces like roads, with MTSS being less prevalent among runners who train on softer surfaces like grass.

Anthropometric and Biomechanical Risk Factors

Reduced calf girth, limited hip external rotation, and decreased ankle dorsiflexion were found to be significantly associated with MTSS. The mean calf girth among those affected by MTSS was notably smaller compared to those without MTSS. This suggests that weaker lower leg musculature is a risk factor for MTSS development.

Another significant finding was the relationship between reduced ankle dorsiflexion and MTSS. Athletes with decreased flexibility in the ankle joint, particularly in dorsiflexion with an extended knee, were more prone to develop MTSS. This was corroborated by several other studies highlighting the importance of ankle biomechanics in preventing tibial stress injuries.

Foot posture, as assessed by the FPI-6, was another critical factor. Runners with higher pronation scores were more likely to develop MTSS, as overpronation can lead to increased stress on the tibial fascia, exacerbating the condition.

Exercise-Related Risk Factors

Runners who trained for longer weekly hours and those who did not incorporate proper warm-up and cool-down routines were more likely to develop MTSS. Interestingly, the study also noted that runners who trained on a combination of different surfaces (track and grass) had

a lower prevalence of MTSS compared to those who exclusively trained on roads.

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Discussion

The findings of this study are consistent with global research on MTSS, which underscores the multifactorial nature of this condition. The high prevalence of MTSS among runners in Peshawar can be attributed to several modifiable and non-modifiable risk factors, including biomechanical and anthropometric variables, as well as training surfaces and routines.

One of the most significant modifiable risk factors identified in this study is calf muscle strength. Strengthening the lower leg muscles, particularly the calf, could help runners prevent MTSS by reducing the stress placed on the tibia during running. Moreover, enhancing ankle dorsiflexion through targeted stretching and flexibility exercises can mitigate the risk of developing MTSS.

Recommendat ons

Based on the findings of this study, several recommendations can be made for coaches, athletes, and healthcare professionals in Peshawar:

1. Surface Mod ficat on: Encouraging runners to train on softer surfaces like grass or alternating between track and grass could significantly reduce the incidence of MTSS. Training exclusively on hard surfaces such as roads should be minimized to prevent overuse injuries.
2. Biomechanical Assessments: Regular assessments of lower
limb biomechanics, including ankle dorsiflexion and foot posture, should be conducted for athletes. Corrective measures like orthotics for overpronation and targeted strength training for calf muscles can be implemented based on these assessments.
3. Warm-up and Cool-down
Pract ces: The practice of engaging in warm-up and cool-down exercises is an important preventive measure that may influence the risk of developing Medial Tibial Stress Syndrome (MTSS).
Warming up before exercise gradually increases blood flow to the muscles, improves flexibility, and prepares the body for physical activity, while cooling down after exercise helps in reducing muscle stiffness and soreness by gradually lowering the heart rate.
In this study, al 46 participants reported practicing proper warm-up and cool- down routines. This implies that the presence of MTSS in the sample was not attributed to the lack of these exercises, but potentially other biomechanical or external factors, such as training surfaces or anatomical risk factors.

Training Surfaces

A variety of running surfaces were used by the participants, which can be a significant factor in the development of MTSS. The type of surface, such as grass, track, or road, influences the impact on the tibia. Harder surfaces like roads are often associated with a higher risk of MTSS due to the increased shock absorption required by the lower limbs during running. In this study:
9% of part cipants ran on track surfaces.
9% ran exclusively on road surfaces.
5% ran on a combination of track and road.
13% ran on grass.
33% utilized a combination of grass and track.
26% used al avai able surfaces, including track, grass, and road.

This diversity in training surfaces allows the study to explore how different terrains impact the prevalence of MTSS.

Durat on of Running Experience

The number of years of running experience is another factor that may influence the development of MTSS. Previous studies have suggested that those with less running experience may be at higher risk due to inadequate biomechanical adaptation and muscle conditioning.
The participants in this study had an average of 5.41 ± 2.86 years of running experience, with the range extending from 1 to 15 years. Longer running experience may serve as a protective factor against MTSS, as it allows the musculoskeletal system to better adapt to repetitive stress.

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Weekly Hours of Running

The duration of weekly running practice can also correlate with the incidence of MTSS. Overtraining, without adequate rest or recovery, can increase stress on the tibia and lower limbs, leading to overuse injuries. The participants in this study reported an average of 7.17 ± 2.86 hours of running per week, with the range being 3 to 24 hours.

Biomechanical Risk Factors

Biomechanical factors, such as joint range of motion (ROM), foot posture, and muscle strength, play critical roles in the development of MTSS. This study measured several biomechanical aspects of the participants' lower limbs to assess their association with MTSS development.

Range of Motion (ROM)

The range of motion in the hip, knee, and ankle joints was measured for both the left and right limbs of the participants.

Limited flexibility or abnormalities in joint ROM can predispose individuals to injuries, including MTSS.

H p Flex on: The average right and left hip flexion was 117.39° ± 8.5°.

H p Extension: The average right hip extension was 38.67° ± 2.1°.

H p Abduction: Right hip abduction was 50.57° ± 2.8° and adduction was 25.26° ± 3.4°.

These ROM values provide insights into how mobility limitations or deviations from the normal range could contribute to MTSS risk.

Foot Posture Index (FPI-6)

The Foot Posture Index-6 (FPI-6) was used to evaluate foot biomechanics, assessing pronation, supination, and neutral postures. Pronation, in particular, is linked to excessive stress on the tibia, contributing to the development of MTSS. The study found that participants with abnormal FPI-6 scores, especially those with pronated feet, were at a higher risk for developing MTSS.

Ankle Dorsiflexion with Knee Extended and Flexed

Ankle dorsiflexion is another significant biomechanical factor associated with the risk of developing MTSS. The ability of the ankle joint to flex properly, both when the knee is extended and flexed, affects the distribution of forces through the lower leg during running. Limited dorsiflexion, especially in conjunction with overpronation, can increase strain on the tibia, leading to the characteristic pain of MTSS.

In this study:

The average right ankle dorsiflexion with knee extended was 11.52° ± 3.0°, and with the knee flexed was 17.93° ± 4.5°.

Similarly, the left ankle dorsiflexion with knee extended averaged 11.35° ± 3.1°, while with the knee flexed it was 17.89° ± 4.5°.

Limited dorsiflexion in these measurements has been shown to correlate with increased risk of MTSS, as it places more stress on the muscles and bones of the lower leg.

Prevalence of MTSS

One of the key aims of this study was to determine the prevalence of Medial Tibial Stress Syndrome among professional runners in Peshawar. The study found that 41.30% of the participants exhibited symptoms of MTSS, which aligns with previously reported prevalence rates in similar athletic populations worldwide. The relatively high prevalence underscores the need for targeted preventive strategies among professional runners.

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Table 1: Represent ng the Prevalence of MTSS among Runners

Gend er	Total Participa nts	Participa nts with MTSS	Percent age with MTSS (%)
Fem ale	3	2	66.67%
Male	43	17	39.53%
Total	46	19	41.30%

Risk Factors for MTSS

This study explored various risk factors associated with the development of MTSS among runners, including anthropometric data, exercise-related habits, and biomechanical factors. The most significant risk factors identified were:

Reduced Calf Girth: Calf girth on both the right and left sides was significantly associated with MTSS development, with p-values of 0.017 for the right calf and 0.002 for the left calf.

Foot Posture: Higher Foot Posture Index (FPI-6) scores were correlated with the development of MTSS, indicating that altered foot posture can influence the distribution of forces through the lower leg, potentially leading to
tibial injury.

Training Surfaces: Participants who predominantly trained on road surfaces were more likely to develop MTSS, as running on hard surfaces increases the impact on the lower limbs. Conversely, those who ran on a combination of grass and track surfaces had a lower prevalence of MTSS, suggesting that softer surfaces may help reduce the risk of injury.

Variable	Score	Sig.
Age	2.834	.092
BMI	.094	.760
Hip_Waist_Ratio	.025	.875
Calf_Girth_R	5.656	.017
Calf_Girth_L	9.726	.002
Total_years_of_running	.263	.608
FPI_6_R	39.261	.000
FPI_6_L	39.478	.000

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Table 2: Chi-square analysis for the Categorical Variables

Chi-Square test		
Variable	Pearson Chi- Square (Sig. Value)	Phi Value
Gender*MTSS	0.772	0.043
Running Surface*MTSS	0.000	0.819

Table: 3 Logist c Regression analysis for the Contnuous Variables

Logistic Regression		
Hip_IR_R	.525	.469
Hip_IR_L	.498	.481
Hip_ER_R	33.754	.000
Hip_ER_L	33.284	.000
Knee_Flexion_R	.153	.696
Knee_Flexion_L	.178	.673
Knee_Extension_R	2.079	.149
Knee_Extension_L	2.907	.088
Ankle_PlantarFlexion_R	42.747	.000
Ankle_PlantarFlexion_L	43.146	.000
Ankle_Eversion_R	35.358	.000
Anke_Eversion_L	37.782	.000
Ankle_Inversion_R	.686	.407
Ankle_Inversion_L	.418	.518
Overall Statistics	45.824	.317

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Logistic Regression		
Variables	Score	Sig.
AD_KE_L	12.671	.000
AD_KE_R	11.621	.000
AD_KF_L	20.637	.000
AD_KF_R	19.041	.000
Hip_Flexion_L	.018	.893
Hip_Flexion_R	.000	.988
Hip_Extension_R	.001	.978
Hip_Extension_L	.005	.944
Hip_Abduction_R	.248	.618
Hip_Abduction_L	.004	.948
Hip_Adduction_R	.633	.426
Hip_Adduction_L	.010	.921

Discussion

The results of this study align with previous research highlighting the importance of biomechanical, anatomical, and environmental factors in the development of MTSS. The high prevalence of MTSS among professional runners in Peshawar indicates that this is a significant health issue that requires attention from both athletes and healthcare professionals.

The findings related to calf girth and ank e dorsiflexion are particularly noteworthy. Previous studies have suggested that stronger and larger calf muscles can help absorb the impact of running, reducing stress on the tibia.

Additionally, proper ankle dorsiflexion allows for more efficient movement during running, which can also decrease the risk of MTSS. These factors emphasize the importance of targeted strength and flexibility training in the prevention of this condition.

Foot posture was another critical factor identified in this study. Runners with pronated feet are at greater risk of developing MTSS due to the increased strain placed on the medial tibial region. This finding suggests that interventions such as orthotics or corrective footwear may be beneficial for runners with pronated feet.

Finally, the role of training surfaces cannot be overlooked. The study found that runners who trained on roads were more likely to develop MTSS, while those who ran on grass or track surfaces were less likely to experience the condition. This suggests that incorporating softer surfaces into training routines may help reduce the risk of MTSS.

Limitat ons

While this study provides valuable insights into the prevalence and risk factors of MTSS among professional runners, several limitations must be acknowledged:

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Sample Size: The study was limited to 46 participants, which may not fully represent the larger population of professional runners in Peshawar or other regions.

Gender Imbalance: The majority of participants were male, with only three female runners included in the study. Given that gender-specific differences in biomechanical factors exist, future research should aim to include a more balanced gender representation.

Self-Reported Data: Some of the exercise-related data, such as weekly running hours and warm- up practices, were self-reported by the participants, which could introduce bias or inaccuracies.

Recommendat ons

Based on the findings of this study, several recommendations can be made to help reduce the prevalence of MTSS among professional runners:

Strength Training: Runners should incorporate calf-strengthening exercises into their training routines to increase muscle mass and improve shock absorption in the lower legs.

Flexibility Training Stretching exercises that improve ankle dorsiflexion should be performed regularly to reduce the strain on the tibia during running.

Footwear and Orthotics: Runners with pronated feet should consider using orthotics or supportive footwear to correct
their foot posture and reduce the risk of MTSS.

Training Surfaces: Athletes should aim to vary their training surfaces, incorporating softer surfaces like grass and track into their routines to minimize the impact on their tibias.

Biomechanical Assessment Regular assessments of running biomechanics, including joint range of motion and foot posture, should be conducted to identify individuals at risk of developing MTSS.

Conclusion

This study has identified a 41.30% prevalence of Medial Tibial Stress Syndrome (MTSS) among professional runners in Peshawar, highlighting the significance of this condition in athletic populations. Several key risk factors were associated with the development of MTSS, including reduced calf girth, limited ankle dorsiflexion, excessive foot pronation, and running on hard surfaces.

Healthcare professionals, coaches, and athletes should be aware of these risk factors to develop targeted prevention strategies. By addressing biomechanical issues, optimizing training surfaces, and focusing on strength and flexibility training, the prevalence of MTSS can be reduced, improving the overall performance and well-being of professional runners.

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