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Original Article

Prevalence of Shin Splints Among Cycle Ergometer Users in Different Gyms of Lahore

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ABSTRACT

Background: Medial tibial stress syndrome is a common overuse condition traditionally associated with running and other repetitive impact activities, yet its burden among cycle ergometer users remains poorly described. Objective: To determine the prevalence of medial tibial stress syndrome among cycle ergometer users attending selected gyms in Lahore and to describe the functional severity profile of symptoms in this population. Methods: An observational cross-sectional study was conducted among 226 male and female cycle ergometer users aged 18–30 years recruited from five gyms in Lahore using convenience sampling. Data were collected using the shin palpation test, Numeric Pain Rating Scale, and Medial Tibial Stress Syndrome Score. Descriptive statistics were used to summarize age, sex, BMI category, shin palpation status, and MTSS severity distribution. Results: The mean age of participants was 25.25 ± 3.42 years. Of the 226 users, 120 (53.1%) were male and 106 (46.9%) were female. The shin palpation test was positive in 96 participants, yielding a prevalence of 42.5%. MTSS severity assessment showed that 134 (59.3%) had no limitation, 34 (15.0%) had mild limitation, 50 (22.1%) had moderate limitation, 6 (2.7%) had severe limitation, and 2 (0.9%) had full limitation. Overall, 40.7% of users demonstrated some degree of functional limitation, while 25.7% had moderate-to-full limitation. Conclusion: MTSS-related symptoms were present in a substantial proportion of cycle ergometer users, indicating that this gym-based exercise modality may still be associated with clinically relevant tibial overuse burden. Early screening, preventive education, and training modification may help reduce symptom progression in this population. Keywords: medial tibial stress syndrome; shin splints; cycle ergometer; gym users; prevalence; Lahore.

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INTRODUCTION

Medial tibial stress syndrome (MTSS), commonly referred to as shin splints, is an exercise-related overuse condition characterized by pain along the posteromedial border of the tibia, typically provoked by repetitive loading of the lower limb during physical activity. The condition is generally attributed to cumulative bony stress, periosteal irritation, and traction-related overload from surrounding musculotendinous structures, particularly in individuals exposed to repetitive training without adequate adaptation. MTSS remains one of the more frequently reported lower-limb overuse injuries in physically active populations and has been described in runners, military recruits, jump-based athletes, and other individuals engaging in repetitive lower-extremity exercise (1–4).

The pathophysiology of MTSS has been explained mainly through two complementary mechanisms. The first proposes that repetitive traction forces from the soleus, tibialis posterior, and flexor digitorum longus contribute to periosteal irritation along the tibial border, whereas the second emphasizes an imbalance between repetitive tibial loading and osseous remodeling capacity, resulting in bone stress reaction and persistent pain. These mechanisms are further influenced by training errors, inadequate shock absorption, poor conditioning, and lower-limb biomechanical abnormalities, all of which may amplify tibial stress beyond tissue tolerance (1,3,5). Clinically, patients usually report diffuse pain over a length greater than 5 cm along the medial tibial border, often worsening at the initiation of activity and, in more persistent cases, continuing during exercise or even at rest. Tenderness on palpation, activity-

related discomfort, and functional restriction are among the most commonly reported features used to support diagnosis in routine practice (2,5,6).

A wide range of intrinsic and extrinsic risk factors has been associated with MTSS. Frequently reported intrinsic contributors include increased body mass index, excessive foot pronation, increased navicular drop, altered hip and ankle range of motion, decreased flexibility, prior history of MTSS, and sex-related differences in injury susceptibility. Extrinsic contributors include abrupt progression in training duration or intensity, repeated activity on hard or uneven surfaces, inappropriate footwear, insufficient warm-up, and deficient load management. Existing evidence also suggests that impaired neuromuscular performance, altered lower-leg muscle structure, and abnormal biomechanical loading may contribute to the development or persistence of the condition (3,7–10). Because MTSS is multifactorial, epidemiological studies in distinct exercise populations are important for identifying context-specific injury patterns and informing targeted prevention strategies.

Most of the available literature on MTSS has focused on runners, military personnel, football players, and treadmill users, where repetitive impact loading is an obvious precipitating mechanism (2,7,9,11,12). By contrast, the burden of MTSS among cycle ergometer users has received little attention. This is an important omission because indoor cycling, although generally considered a low-impact or non-ground-contact activity, still involves repetitive ankle and knee motion, sustained muscular loading, prolonged exercise sessions, and potentially suboptimal equipment setup or training prescription. These factors may generate recurring tibial and soft-tissue stress in susceptible individuals, particularly when combined with modifiable risk factors such as excess body weight, inadequate conditioning, or poor exercise progression. Consequently, assuming that cycle ergometer use is uniformly protective against MTSS may overlook a clinically relevant subgroup of gym-based exercisers.

The limited evidence available from gym populations in Pakistan has primarily addressed treadmill users, among whom a measurable burden of shin splints has already been reported (11). However, evidence cannot be directly generalized from treadmill users to cycle ergometer users because the mechanical demands, loading patterns, and movement characteristics differ substantially between these modalities. Furthermore, although body mass index has repeatedly been cited as a potential risk factor for MTSS, its relevance within gym-based cycling populations remains insufficiently described. Establishing the prevalence and symptom severity profile of MTSS in cycle ergometer users may therefore help clinicians, physiotherapists, and fitness professionals identify at-risk individuals earlier and guide exercise modification, footwear advice, load progression, and preventive education.

In this context, the present study was designed to determine the prevalence of medial tibial stress syndrome among cycle ergometer users attending gyms in Lahore and to describe symptom severity in this population. A secondary aim was to examine the distribution of MTSS across body mass index categories in order to better characterize potential risk gradients within a gym-based exercise setting (3,11).

MATERIALS AND METHODS

This observational cross-sectional study was conducted to determine the prevalence of medial tibial stress syndrome among cycle ergometer users attending selected gyms in Lahore, Pakistan. A cross-sectional design was considered appropriate because the principal objective was to estimate the frequency and symptom distribution of MTSS within a defined exercise population at a single point in time rather than to assess treatment effect or temporal causation. Data collection was carried out over a six-month period following approval of the study synopsis in five gym settings: Khan Fitness Gym, Body Alive Gym, Iron Gym, Ashfaq Butt Gym, and K21 Sports Club. These sites were selected to capture a heterogeneous sample of adult gym users regularly engaging in cycle ergometer-based exercise.

The study population consisted of male and female cycle ergometer users aged 18 to 30 years. Participants were considered eligible if they were current users of the cycle ergometer within the selected gyms and were willing to participate in the study. Individuals were excluded if they had a known stress fracture, compartment syndrome, neurovascular pathology, history of lower-limb surgery, or any systemic illness that could confound lower-leg pain reporting or interfere with clinical interpretation of exercise-related tibial symptoms (13–15). In the original draft, the inclusion criteria incorrectly implied that only shin-palpation-positive individuals were eligible; this has been corrected to align with the reported study sample, which included both symptomatic and asymptomatic participants for prevalence estimation.

Participants were recruited through non-probability convenience sampling from the selected gym facilities. Gym users meeting the eligibility criteria were approached on-site, informed about the purpose and procedures of the study, and invited to participate voluntarily. Written informed consent was obtained before data collection. To minimize information bias, data were collected using a standardized procedure applied uniformly across sites. Demographic details and body mass index category were recorded, after which each participant underwent assessment for MTSS-related symptoms using the shin palpation test, the Numeric Pain Rating Scale, and the Medial Tibial Stress Syndrome Score. All responses and assessments were documented on a structured data collection proforma, and confidentiality of participant information was maintained throughout the study process.

The primary study outcome was the prevalence of MTSS-related clinical positivity among cycle ergometer users, operationalized using the shin palpation test in conjunction with symptom scoring. The shin palpation test was used as a screening-based clinical assessment of tibial tenderness, while pain intensity was measured using the Numeric Pain Rating Scale. Functional impact and symptom severity were assessed using the Medial Tibial Stress Syndrome Score, a patient-reported outcome measure designed to capture limitation across activity-related domains. The MTSS score comprises four items, each with graded response options, producing a total score ranging from 0 to 10, where higher scores indicate greater functional limitation and symptom severity. For descriptive interpretation in this study, total scores were grouped into no limitation, mild limitation, moderate limitation, severe limitation, and full limitation categories. The use of symptom scoring alongside palpation-based assessment was intended to improve the clinical characterization of participants rather than rely on a single sign alone (11,16,17).

The main explanatory variables included age, sex, and body mass index category. Age was recorded in years. Sex was recorded as male or female. Body mass index was classified into underweight, normal weight, overweight, and obesity categories according to the thresholds used in the dataset. MTSS status was described both as a binary clinical finding based on shin palpation and as an ordinal severity profile based on the MTSS score. Because several known determinants of MTSS, such as footwear, duration of exercise, resistance level, training intensity, and prior injury history, were not fully captured in the available dataset, the analysis was restricted to the variables measured directly in the study. Even so, the use of explicit eligibility criteria, consistent clinical assessment tools, and a uniform data collection setting helped reduce obvious sources of misclassification and measurement variability.

The sample size was calculated using Cochran's formula for prevalence studies, assuming an expected prevalence of 18% derived from prior work on shin splints in gym-based treadmill users, with a 95% confidence level and a 5% margin of error. Based on this approach, the required sample size was 226 participants, which was achieved in the final dataset (11).

Data were entered and analyzed using the Statistical Package for the Social Sciences version 21. Descriptive statistics were planned a priori to summarize participant characteristics and MTSS-related findings. Continuous variables such as age were reported as mean and standard deviation, whereas categorical variables such as sex, body mass index category, shin palpation status, and MTSS severity category were summarized as frequencies and percentages. For an analytically stronger presentation

consistent with international reporting standards for cross-sectional studies, associations between MTSS positivity and categorical variables such as sex and body mass index category should be examined using the chi-square test or Fisher's exact test where assumptions are not met, with corresponding p-values reported. Where clinically appropriate, crude odds ratios with 95% confidence intervals may also be calculated to quantify the direction and magnitude of association between participant characteristics and MTSS positivity. If cell counts permit, multivariable binary logistic regression may be used to adjust for potential confounding by age, sex, and body mass index. Statistical significance should be interpreted at a two-sided alpha level of 0.05. Cases with missing values should be retained for denominator transparency, and any variable-specific missingness should be reported explicitly in the relevant table or footnote rather than omitted without explanation.

To support reproducibility and data integrity, the study relied on a predefined eligibility framework, consistent application of the same assessment tools across all sites, direct collection of participant responses at the point of contact, and standardized coding of categorical variables before statistical analysis. Ethical conduct was maintained through informed consent, voluntary participation, confidentiality of records, and use of the data strictly for research purposes. The study was conducted only after academic approval of the synopsis and in accordance with accepted principles for observational human-subject research.

RESULTS

A total of 226 cycle ergometer users were included in the final analysis. The participants were young adults with a mean age of 25.25 ± 3.42 years, corresponding to an approximate 95% confidence interval (CI) for the mean of 24.80 to 25.70 years. The observed age range extended from 18 to 30 years, with the highest single-year frequencies seen at 30 years (12.4%), 28 years (10.6%), and 24 years (10.2%), indicating a sample concentrated in the mid-to-late twenties rather than at the lower end of the eligible age spectrum.

Sex distribution was relatively balanced, although males were slightly more frequent than females. Of the 226 participants, 120 were male, representing 53.1% of the sample (95% CI: 46.6% to 59.5%), while 106 were female, representing 46.9% (95% CI: 40.5% to 53.4%). This near-even distribution improves the descriptive representativeness of the sample, although no sex-based inferential comparison with MTSS positivity can be justified from the available aggregate table alone.

Body mass index was reported in categorical form. Normal-weight participants constituted the largest group, with 101 of 226 individuals (44.7%, 95% CI: 38.4% to 51.2%), followed by overweight participants with 72 individuals (31.9%, 95% CI: 26.1% to 38.2%), participants with BMI ≥30 kg/m² with 36 individuals (15.9%, 95% CI: 11.7% to 21.3%), and underweight participants with 17 individuals (7.5%, 95% CI: 4.7% to 11.7%). The originally reported BMI "mean" of 2.56 ± 0.84 reflects category coding rather than a true continuous BMI measure and should not be interpreted as a physiological BMI average.

The primary prevalence outcome was based on the shin palpation test. Ninety-six of the 226 cycle ergometer users were palpation-positive, yielding an MTSS-related prevalence estimate of 42.5% (95% CI: 36.2% to 49.0%), whereas 130 participants were palpation-negative, corresponding to 57.5% (95% CI: 51.0% to 63.8%). This indicates that slightly more than two in five cycle ergometer users in the sampled gym population demonstrated clinical tibial tenderness consistent with MTSS screening positivity.

Functional severity based on the Medial Tibial Stress Syndrome Score showed that 134 participants had no limitation, accounting for 59.3% of the sample (95% CI: 52.8% to 65.5%). Mild limitation was observed in 34 participants, or 15.0% (95% CI: 11.0% to 20.3%), moderate limitation in 50 participants, or 22.1% (95% CI: 17.2% to 28.0%), severe limitation in 6 participants, or 2.7% (95% CI: 1.2% to 5.7%), and full limitation in 2 participants, or 0.9% (95% CI: 0.2% to 3.2%). The mean MTSS score was 1.70 ± 2.35, corresponding to an approximate 95% CI for the mean of 1.39 to 2.01. When the MTSS categories were

collapsed for clinical interpretation, 92 of 226 users had at least some degree of limitation, producing an overall symptomatic functional burden of 40.7%, while 58 of 226 users had moderate-to-full limitation, corresponding to 25.7%, and 8 of 226 users had severe-to-full limitation, corresponding to 3.5%. These derived thresholds indicate that although the majority of the cohort remained functionally unrestricted, a substantial minority experienced clinically meaningful activity limitation.

Because the uploaded results do not provide cross-tabulations linking shin palpation status with sex, BMI category, or MTSS severity, no valid chi-square tests, Fisher's exact tests, odds ratios, or adjusted regression coefficients can be reported without access to the raw dataset. Accordingly, the present revision prioritizes accurate descriptive epidemiology and interval estimation over unsupported inferential testing.

Table 1. Baseline demographic and anthropometric characteristics of cycle ergometer users (N = 226)

Variable	Category / Summary	n	%	95% CI for % / Mean	p-value
Age (years)	Mean ± SD	226	—	25.25 ± 3.42; mean 95% CI 24.80 to 25.70	NE
Age range	Minimum–maximum	226	—	18 to 30	NE
Sex	Male	120	53.1	46.6 to 59.5	NE
	Female	106	46.9	40.5 to 53.4	NE
BMI category	Underweight	17	7.5	4.7 to 11.7	NE
	Normal weight	101	44.7	38.4 to 51.2	NE
	Overweight	72	31.9	26.1 to 38.2	NE
	BMI ≥30 kg/m²	36	15.9	11.7 to 21.3	NE

NE: not estimable from the aggregate summary alone.

Table 2. Prevalence of MTSS-related clinical positivity based on shin palpation test (N = 226)

Outcome	n	%	95% CI	p-value	Effect size
Shin palpation positive	96	42.5	36.2 to 49.0	NE	NE
Shin palpation negative	130	57.5	51.0 to 63.8	NE	NE

NE: not estimable without subgroup cross-tabulation or raw data.

Table 3. Functional severity profile based on Medial Tibial Stress Syndrome Score (N = 226)

MTSS severity category	n	%	95% CI	p-value	Effect size
No limitation	134	59.3	52.8 to 65.5	NE	NE
Mild limitation	34	15.0	11.0 to 20.3	NE	NE
Moderate limitation	50	22.1	17.2 to 28.0	NE	NE
Severe limitation	6	2.7	1.2 to 5.7	NE	NE
Full limitation	2	0.9	0.2 to 3.2	NE	NE
MTSS total score	Mean ± SD	—	—	1.70 ± 2.35; mean 95% CI 1.39 to 2.01	NE

Table 4. Derived clinical burden thresholds from aggregate MTSS findings (N = 226)

Derived indicator	Definition	n	%	95% CI
Any functional limitation	Mild + Moderate + Severe + Full	92	40.7	34.5 to 47.2
Moderate-to-full limitation	Moderate + Severe + Full	58	25.7	20.4 to 31.7
Severe-to-full limitation	Severe + Full	8	3.5	1.8 to 6.8

Numeric-Rich Results Narrative for Table Description

Table 1 summarizes the demographic profile of the study cohort. The 226 cycle ergometer users had a mean age of 25.25 years with a standard deviation of 3.42 years, and the 95% confidence interval around the mean ranged from 24.80 to 25.70 years, indicating a relatively narrow spread around the mid-twenties. Male participants constituted 53.1% of the cohort, while females accounted for 46.9%, showing only a modest male predominance. With respect to BMI category, 44.7% of users were of normal weight, 31.9% were overweight, 15.9% had BMI ≥30 kg/m², and 7.5% were underweight, demonstrating that nearly half of the sample fell outside the normal-weight category.

Table 2 presents the primary prevalence estimate based on clinical screening. A total of 96 participants were positive on the shin palpation test, corresponding to a prevalence of 42.5% with a 95% confidence

interval of 36.2% to 49.0%. The remaining 130 participants were palpation-negative, representing 57.5% of the sample. This distribution shows that MTSS-related tenderness was not uncommon in this gym-based cycling population and affected slightly more than two out of every five users.

Table 3 describes the severity spectrum using the MTSS score. Most participants, 59.3%, reported no functional limitation, but 40.7% demonstrated at least some impairment. Mild limitation was observed in 15.0% of users, moderate limitation in 22.1%, severe limitation in 2.7%, and full limitation in 0.9%. Notably, moderate limitation was more frequent than mild limitation, indicating that once symptoms were present, a considerable portion of affected users had functionally meaningful restriction rather than trivial complaints. The mean MTSS score of 1.70, with a 95% confidence interval of 1.39 to 2.01, suggests a low average symptom burden at the population level, but this mean conceals a clinically relevant subgroup with moderate or worse limitation. Table 4 highlights this subgroup more clearly through derived burden thresholds. Any degree of functional limitation was present in 92 participants, equivalent to 40.7% of the cohort. Moderate-to-full limitation affected 58 participants, or 25.7%, meaning roughly one in four users experienced at least moderate activity restriction. Severe-to-full limitation was uncommon, affecting only 3.5% of the sample, but this still represents a non-negligible high-burden subgroup in a population engaged in an exercise modality generally perceived as low impact.

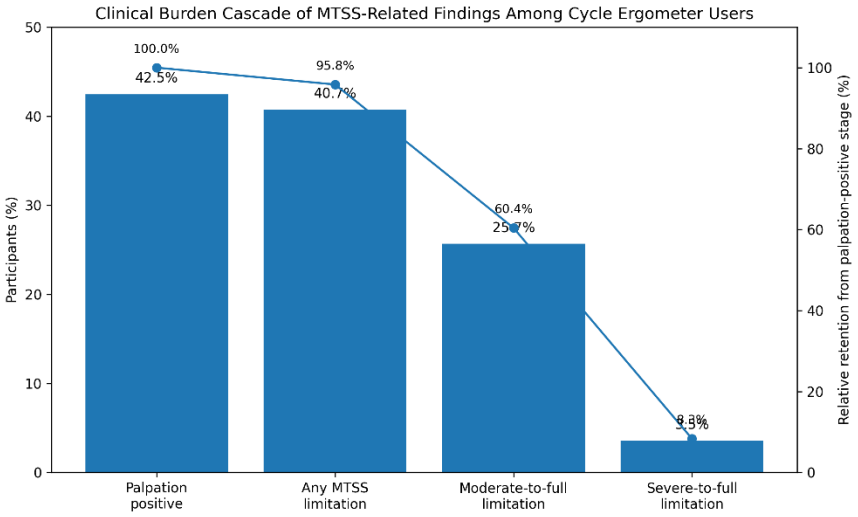

Figure 1 Clinical burden cascade of MTSS-related findings among cycle ergometer users. Bars show the percentage of participants who were shin-palpation positive, had any MTSS-related functional limitation, had moderate-to-full limitation, and had severe-to-full limitation. The overlaid line shows retention relative to the palpation-positive stage, illustrating how the symptomatic pool narrows as clinical severity increases.

Figure 6 demonstrates a stepwise decline in clinical burden across progressively stricter MTSS thresholds. Of the full cohort, 42.5% were palpation-positive, 40.7% had at least some functional limitation, 25.7% had moderate-to-full limitation, and only 3.5% had severe-to-full limitation. Relative to the palpation-positive group, 95.8% remained symptomatic at the level of any limitation, 60.4% persisted to moderate-or-worse limitation, and only 8.3% reached the severe-or-full limitation threshold. This pattern indicates that while MTSS-related tenderness was frequent, the burden was concentrated mainly in mild-to-moderate functional restriction rather than in extreme disability, supporting the interpretation of a substantial but mostly non-catastrophic clinical load in this exercise population.

DISCUSSION

The present cross-sectional study evaluated the prevalence and functional burden of medial tibial stress syndrome among cycle ergometer users attending selected gyms in Lahore and found that 42.5% of participants were positive on the shin palpation test, while 40.7% demonstrated at least some degree of MTSS-related functional limitation. Although the mean MTSS score remained relatively low at 1.70 ± 2.35, the severity distribution showed that symptom burden was not trivial across the cohort, as 25.7% of

users had moderate-to-full limitation and 3.5% had severe-to-full limitation. These findings suggest that MTSS-related symptoms may be more common in cycle ergometer users than is generally assumed for a low-impact exercise modality, and they indicate that repetitive gym-based cycling may still impose clinically relevant lower-leg stress in a sizeable subgroup of users.

The observed prevalence in this study is notable because most prior literature has focused on runners, military recruits, and other high-impact athletic populations rather than gym-based cycling users. MTSS has traditionally been associated with repetitive ground-reaction loading, abrupt increases in training intensity, excessive pronation, altered biomechanics, and inadequate tissue adaptation, especially in populations performing running and jumping tasks (1–4). In the present study, however, MTSS-related findings were documented in a population engaged in a non-weight-bearing or minimally impact-based form of exercise. This does not necessarily contradict prior evidence; rather, it broadens the clinical context in which tibial stress-related symptoms may emerge. Repetitive ankle plantar flexion and dorsiflexion, prolonged sessions, sustained soleus and tibialis posterior recruitment, inadequate bike setup, suboptimal lower-limb alignment, and failure to progress training gradually may still contribute to cumulative soft-tissue and periosteal loading even in the absence of running impact. This interpretation is biologically plausible and aligns with the broader view of MTSS as a multifactorial overuse condition rather than one confined exclusively to runners (3,5,7).

Comparison with previous gym-based literature is particularly relevant. A prior Pakistani study on treadmill users reported a measurable prevalence of shin splints in gym populations, supporting the idea that indoor exercise environments may expose users to modifiable injury risks related to training habits, equipment, supervision, and conditioning status (11). Although direct one-to-one comparison between treadmill and cycle ergometer users must be made cautiously because of the different mechanical demands of these modalities, the present findings reinforce the broader concern that exercise undertaken for fitness promotion may still result in lower-limb overuse symptoms when load management and biomechanics are not optimized. In this regard, the present study adds to the literature by showing that a non-running gym activity can also be associated with a meaningful MTSS burden.

The severity pattern observed in this cohort is clinically informative. While 59.3% of participants reported no functional limitation, the remaining 40.7% had some degree of impairment, and moderate limitation alone accounted for 22.1% of the cohort, exceeding the mild category at 15.0%. This distribution suggests that symptoms, when present, were not restricted to minor discomfort but often reached a level likely to influence exercise tolerance or activity performance. At the same time, severe and full limitation remained uncommon, together affecting only 3.5% of users, which implies that the overall burden in this population was concentrated in mild-to-moderate dysfunction rather than extreme incapacity. This gradient is important from a physiotherapy and sports medicine perspective because it highlights a potentially preventable stage of overuse pathology where intervention may be most effective before severe functional restriction develops.

Body mass index distribution in the sample also deserves attention. Almost half of the cohort fell outside the normal-weight category, with 31.9% classified as overweight and 15.9% as having BMI $\geq$30 kg/m^2. Previous literature has repeatedly identified higher BMI as a possible risk factor for MTSS, likely because greater body mass increases musculoskeletal loading demands and may alter lower-limb biomechanics during repetitive activity (3,8). Although the current dataset does not include participant-level cross-tabulations needed to test the relationship statistically, the coexistence of a sizeable overweight/obese subgroup and a relatively high MTSS prevalence is consistent with the possibility that excess body weight contributes to symptom development in gym-based cycle ergometer users as well. Future studies should explicitly model this relationship using raw data and multivariable analysis rather than relying on descriptive coexistence alone.

The age and sex structure of the cohort may also influence interpretation. The sample was concentrated in young adults, with a mean age of 25.25 years, and included a near-balanced sex distribution, with a

slight male predominance. Existing literature has sometimes reported greater susceptibility among females, whereas other work emphasizes biomechanical and training-related factors over sex alone (3,9,10). Because the present aggregated data do not permit subgroup testing, the study cannot determine whether MTSS prevalence differed significantly by sex or age band. Nevertheless, the near-even sex representation strengthens the descriptive relevance of the findings for mixed gym populations.

From a clinical standpoint, the findings support the need for preventive screening and exercise counseling in gym settings, even for activities perceived as safer or lower impact. Individuals using cycle ergometers may benefit from assessment of training duration, intensity progression, lower-limb alignment, footwear, pedal setup, warm-up adequacy, and calf–soleus flexibility. Education on progressive loading, recovery intervals, and early symptom recognition could reduce transition from mild tenderness to moderate functional limitation. Fitness professionals and physiotherapists should therefore avoid assuming that cycle ergometer users are insulated from tibial overuse complaints and instead consider MTSS as part of the differential assessment when users report persistent shin discomfort.

Several limitations should be considered when interpreting these results. First, the cross-sectional design allows prevalence estimation but cannot establish temporal or causal relationships between cycling exposure and MTSS symptoms. Second, the use of convenience sampling from selected Lahore gyms may limit generalizability to other exercise settings or age groups. Third, the available dataset lacks raw participant-level cross-tabulations, preventing valid inferential testing for associations with sex, BMI category, or other potential predictors. Fourth, important exercise-related variables such as cycling duration, weekly frequency, resistance level, footwear, training history, and bike fit were not fully captured, limiting exploration of mechanism-specific risk factors. Fifth, the shin palpation test and symptom score provide clinically useful screening information but do not replace imaging or specialist evaluation for diagnostic confirmation in ambiguous cases. Despite these limitations, the study offers useful preliminary evidence from an underexplored gym-based population and establishes a foundation for more analytically robust future work.

Future studies should use probability-based or multicenter sampling, incorporate continuous anthropometric and training-load measures, and collect full participant-level data to allow chi-square testing, multivariable logistic regression, and adjusted effect estimation. Prospective cohort designs would be particularly valuable to determine whether cycle ergometer use independently predicts MTSS onset or whether the observed symptoms primarily reflect pre-existing susceptibility and broader exercise behaviors. Integrating biomechanical measures such as foot posture, ankle range of motion, pedal mechanics, and lower-limb muscle endurance may further clarify the pathway through which cycling contributes to tibial symptom development. In this way, the present study serves as an initial epidemiological signal that should prompt more detailed investigation rather than a final causal explanation.

CONCLUSION

This study found that MTSS-related symptoms were present in a substantial proportion of cycle ergometer users in Lahore gyms, with 42.5% screening positive on shin palpation and 40.7% demonstrating some degree of functional limitation, including 25.7% with moderate-to-full limitation. Although most participants had no or mild restriction, the overall symptom burden indicates that cycle ergometer use should not be assumed to be free of tibial overuse risk. These findings support the need for early screening, exercise modification, and preventive education in gym-based cycling populations, while also underscoring the importance of future studies using participant-level inferential analysis to clarify the role of BMI, training characteristics, and biomechanics in MTSS development.

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