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MUSCULOSKELETAL SCREENING AMONG SPRINTERS IN SANGLI DISTRICT – AN OBSERVATIONAL STUDY

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Abstract: Introduction**:** Running has gained immense popularity over the last few decades, leading to an increased number of running-related injuries. Unlike the overuse injuries observed among long-distance runners, sprinters are more prone to acute musculoskeletal injuries (ligament sprains and muscle strains). Sprinting involves covering a distance of 100-400 meters, while maximizing speed over short distances. The demands of acceleration, top speed, and deceleration phases often result in injuries in sprinters. By identifying the prevalent injury locations and patterns among sprinters, this study intends to improve performance through focused injury-prevention techniques. This study aimed to understand common musculoskeletal disorders, assess lower extremity functional limitations, and evaluate pain-related disability and psychological risk factors among sprinters. Methods: A study was conducted, and participants aged 18-35 years meeting the inclusion criteria were selected; the sample size was calculated to be n=220. Data were collected using questionnaires comprising demographics, sprinting distance, years of running experience, and outcome measures (Modified Nordic Musculoskeletal Questionnaire, Lower Extremity Functional Scale, and Orebro Musculoskeletal Pain Questionnaire). Results: Among the 220 participants, females slightly outnumbered males. Most participants were aged 18-27 years. The knee was the most commonly affected joint. A weak, non-significant correlation was found between the LEFS and Orebro scores. Conclusion: This study demonstrates that musculoskeletal involvement is common among competitive sprinters, with the knee being the most frequently affected joint. No significant correlation was observed between functional ability (LEFS) and pain-related disability (Orebro scores).

Keywords: Athletes, musculoskeletal injuries, observational study, running-related injuries, sports physiotherapy.

INTRODUCTION

Running has gained significant popularity over the past few decades. Participation in running activities has increased in pursuit of a healthy lifestyle (Kakouris, 2021) (Gallo, 2012). In addition to exercise, running has become increasingly popular as a recreational activity. Engaging in physical activities such as running is advantageous for the entire body; it enhances endurance, reduces the likelihood of cardiovascular illnesses, and aids in weight loss (Gallo, 2012) (Popper, 2021).

Running requires enhanced balance due to having a somewhat smaller base of support and lacking the double-support phases which are a characteristic of walking, along with the occurrence of float phases when both feet are above the ground (Levangie, 2011). As running speed increases, the duration of the gait cycle spent in the float phases will likewise increase (Levangie, 2011). Muscles must produce more power to elevate the head, arms, and trunk higher than in typical walking and to maintain balance and support during the gait cycle. Additionally, the muscles and joint structures must absorb more energy to manage and control the weight of the head (Levangie, 2011).

Sprinting is a fast-paced, brief style of running that focuses on achieving the top speed over distances of 100–400 m. In contrast to endurance running, sprinting depends significantly on anaerobic energy systems and muscle power (Pietraszewski, 2025). In many sports, such as football, rugby, soccer, and track and field, where running at maximum velocity and rapid acceleration are critical to performance, sprinting is essential (Pietraszewski, 2025). The dynamic balance of neuromuscular activation, movement kinematics, and fatigue response results in sprinting performance (Pietraszewski, 2025).

Running for sprinters involves more than just covering distance; it also involves maximizing speed over short distances, typically between 60 and 400 m. In addition to requiring certain biomechanical, neuromuscular, and musculoskeletal needs, sprinting differs from endurance running because of its high forces, rapid accelerations, decelerations, and forceful muscle contractions (Pietraszewski, 2025) (Bartosz-Jeffries, 2025).
Both kinematic (stride length and frequency) and kinetic (force production and ground reaction forces) elements affect sprinting speed; to attain maximum acceleration and top velocity, these factors must be tuned (Pietraszewski, 2025) (Clark, 2025).
According to recent meta-analyses of muscle activation during sprinting, the posterior thigh muscles, especially the biceps femoris and gluteus maximus, are significantly more activated with increased sprint velocity. The ground reaction forces and stride length also increased, and the stride frequency, although still significant, did not change as sharply (Pietraszewski, 2025). These traits also suggest that tiredness has important consequences, including altered hip and knee flexion, longer ground contact durations, and an earlier beginning of muscle activation, all of which may increase the risk of injury (Pietraszewski, 2025) (Bartosz-Jeffries, 2025).
Unlike overuse injuries that are frequent in distance running, sprinters typically sustain acute musculoskeletal ailments (such as ligament sprains and muscle strains) (Bramah, 2024). While many injury prevention programs focus on strengthening (especially eccentric training) to withstand mechanical strain, a recent study has pointed out that less attention has been paid to how sprint biomechanics create strain and how they might be changed (Bramah, 2024) (Meng, 2024).
The high demands of acceleration, top speed, and deceleration phases often result in injuries among sprinters. Moreover, chronic musculoskeletal damage may result from repeated sprinting without sufficient rest. Standardized screening is crucial for identifying these problems to improve performance, prevent long-term disability, and direct physiotherapy interventions. Compared with endurance running, sprinting exposes athletes to different injury patterns because of its specific biomechanical and physiological demands. Training can be optimized, injury load can be decreased, and preventive physiotherapy can be guided by the early detection of musculoskeletal dysfunctions through structured screening.
Compared with athletes in other sports, sprinters are more prone to musculoskeletal injuries because of their prolonged exposure to high velocity and repetitive mechanical stress. By identifying the prevalent injury locations and patterns among sprinters, this study intends to improve performance through physiotherapy interventions and focused injury-prevention techniques. Furthermore, even though athletics is becoming increasingly popular in India, not much is known about musculoskeletal screening among sprinters in rural areas like Sangli. The majority of the literature now in publication concentrates on elite athletes from global or urban settings. This study aimed to close this gap by using validated questionnaires to thoroughly evaluate the musculoskeletal health of sprinters and offer region-specific insights that can direct future training and rehabilitation initiatives.

LITERATURE REVIEW

Clark et al. 2025; this research analyzes angular kinematics during top-speed sprinting in male athletes. It highlights the importance of optimal joint angles at the hip, knee, and ankle for efficient sprinting. Deviations in kinematics are associated with reduced performance and increased injury risk, particularly in the hamstrings, emphasizing the need for technique optimization. Bartosz-Jeffries et al. 2025; this study examines neuromuscular and performance responses to resisted sprint training in elite female sprinters. It finds that resisted sprinting enhances muscle activation and power output but may also increase 11 mechanical stresses on muscle and joints. The paper suggests that while such training improves performance, improper load management can elevate injury risk. Pietraszewski et al. 2025; this meta-analysis reviews muscle activity and biomechanics during sprinting, highlighting the critical role of hamstrings, gluteal, and calf muscles in force production and propulsion. It shows that high-intensity sprinting places significant strain on posterior chain muscles, increasing injury risk. The study emphasizes neuromuscular coordination and efficient biomechanics as key factors in both performance and injury prevention. Moreira et al. 2024; this prospective study analyzes the incidence and biomechanical risk factors for running-related injuries. It identifies abnormal gait patterns, poor shock absorption, and muscle imbalances as significant predictors. The study supports the use of biomechanical assessments in identifying at-risk individuals and tailoring preventive interventions. Dande et al. 2024; this retrospective study examines lower-extremity musculoskeletal injuries in track and field athletes. It reports a high incidence of injuries in the knee and ankle regions, often linked to repetitive stress and inadequate recovery. The study emphasizes early identification and proper rehabilitation to prevent chronic conditions. Meng et al. 2024; this study investigates spatiotemporal kinematics during top speed sprinting, focusing on parameters like stride length, frequency, and ground contact time. It finds that inefficient patterns can lead to increased mechanical load 10 and injury susceptibility. The research highlights the importance of optimizing these variables for both performance and injury prevention. Bramah et al. 2024; this study explores the relationship between sprint biomechanics and hamstring strain injuries. It identifies factors such as excessive anterior pelvic tilt, over striding, and poor neuromuscular control as contributors to injury. The paper concludes that biomechanical inefficiencies during high-speed running significantly increase hamstring strain risk. Popper et al. 2021; this systematic review investigates risk factors

Table 1: Age wise distribution of study participants

Age Group(yrs)	No of study participants	Percentage
18-27 yrs	125	56.82
28-37 yrs	95	43.18
Total	220	100
Mean ± SD	26.42 ± 4.95(18-35 years)	

associated with overuse injuries in short- and- long distance running. It identifies key intrinsic factors like muscle weakness, joint stability, and poor biomechanics, along with extrinsic factors such as training volume and surface. The study concludes that injury risk is not due to a single cause but rather an interaction of multiple variables, reinforcing the need for individualized injury prevention programs. Kakouris et al. 2021; this systematic review provides a comprehensive overview of running-related musculoskeletal injuries (RRMIs), highlighting their high prevalence among recreational and competitive runners. It identifies commonly affected regions such as the knee, ankle, and lower leg, with patellofemoral pain syndrome being most frequent. The study emphasizes multifactorial causation, including training errors, biomechanical abnormalities, and inadequate recovery, and stresses the importance of preventive strategies focusing on load management and conditioning.

METHODOLOGY

Study Design: An observational study was conducted to determine the prevalence of musculoskeletal problems among competitive sprinters in and around Sangli district. An observational study design was chosen as no intervention was applied, and the study aimed to assess the existing conditions within the study population at a single point in time.

Study setting: This study was conducted on competitive sprinters from Sangli district. Data was collected from athletes training at various sports grounds and clubs within Sangli district.

Study Population: The study population consisted of competitive sprinters who met predefined inclusion criteria. A total of 220 participants were included in the study after screening for the eligibility criteria.

Inclusion Criteria

- Participants who provided informed consent were included in the study.
- Competitive sprinters aged between 18-35years of age with a minimum sprint training experience of 1 year were eligible for the study.
- Both male and female athletes were included in the study.

Exclusion Criteria

- Sprinters with a history of any recent (<3months) fractures, major surgery, or any systemic illness were excluded from the study.
- Athletes with acute injuries preventing their participation in screening were not eligible.
- Athletes involved in any kind of long-distance/marathon running were excluded.

Data collection tools: The screening for any musculoskeletal problem associated with running was done which include the demographics (age, gender, sprinting distance and the years of running experience), standardised assessment scales were used which included,

1. Modified Nordic Musculoskeletal Questionnaire for localizing musculoskeletal problems.
2. Lower Extremity Functional Scale (LEFS) to assess the functional limitations associated with lower extremity musculoskeletal conditions.
3. Orebro Musculoskeletal Pain Questionnaire to evaluate pain-related disability and psychosocial risk factors.

All questionnaires were self-administered, and clarification was provided to participants whenever required to ensure accurate responses.

Study Procedure: Eligibility was assessed using specific inclusion and exclusion criteria for the study. The participants were informed of the purpose of the study, and written consent was obtained prior to data collection. The questionnaires were then distributed and completed under supervision to minimize missing or incomplete responses to questions. Confidentiality of the participants' information was maintained throughout the study.

Data Analysis: Statistical analysis was performed using descriptive and inferential statistics using Pearson's correlation coefficient and software used for analysis was **SPSS 27.0 version** and $p<0.05$ was considered statistically significant.

Table 2: Gender wise distribution of study participants

Gender	No of study participants	Percentage
Male	106	48.18
Female	114	51.82
Total	220	100

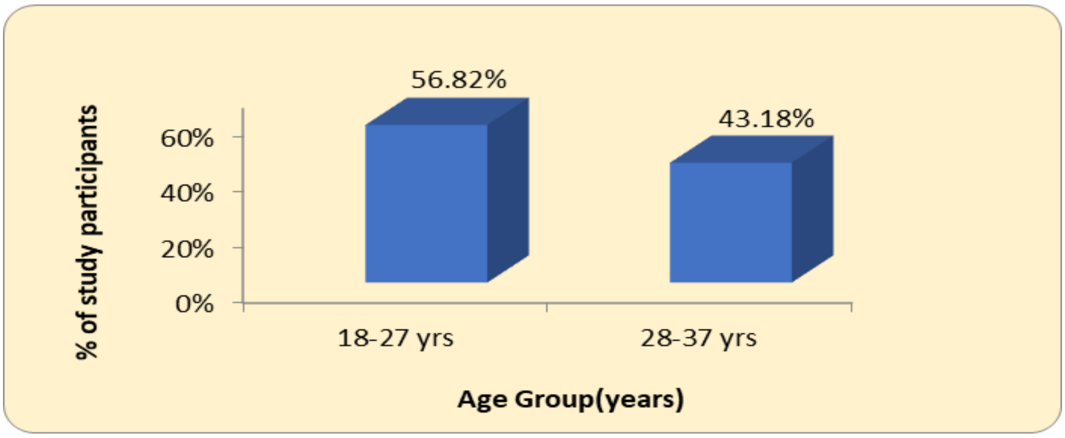

Figure 1: Age wise distribution of study participants

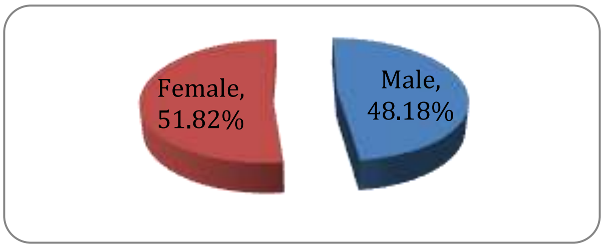

Figure 2: Gender wise distribution of Study Participants

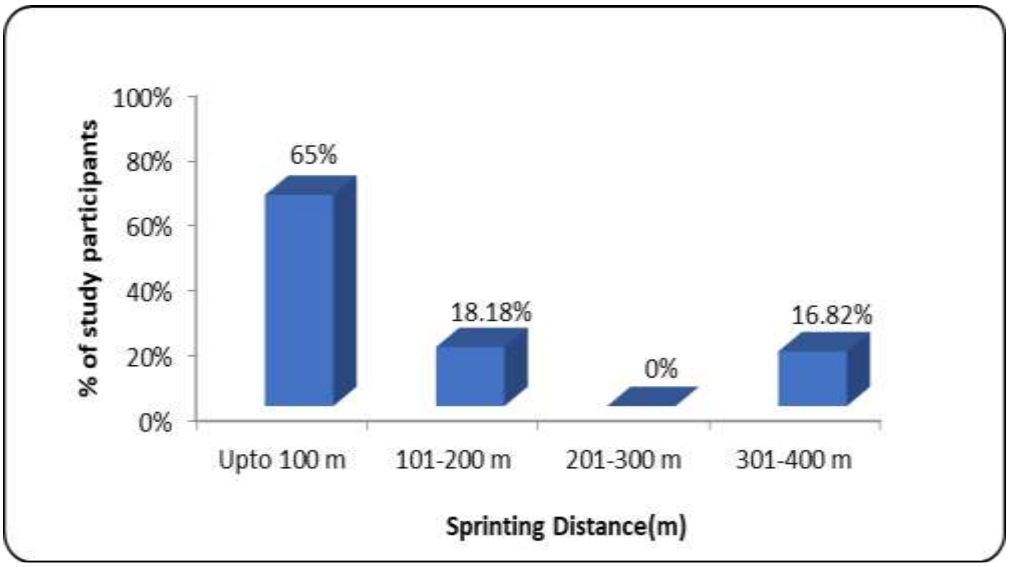

Figure 3: Distribution of study participants according to sprinting distance

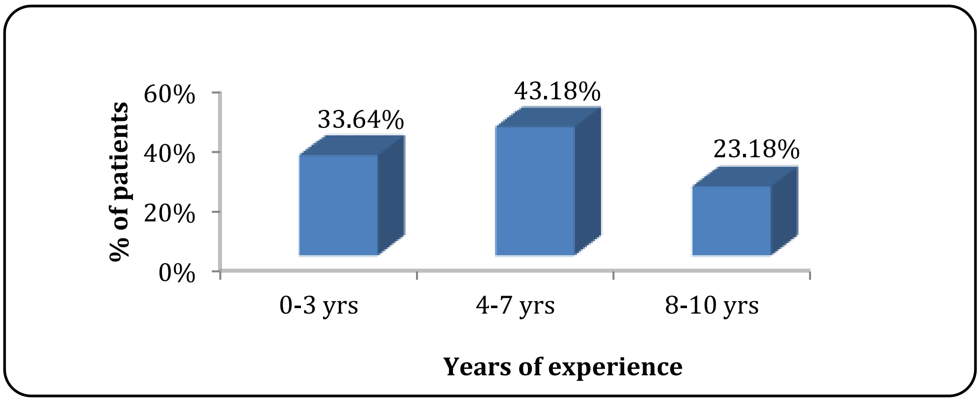

Figure 4: Distribution of study participants according to years of experience

Table 5: Distribution of study participants according to Joint Involved

Joint Involved	No of study participants	Percentage
Ankle	52	23.64
Knees	68	30.91
Low Back	46	20.91
Neck	54	24.55
Total	220	100

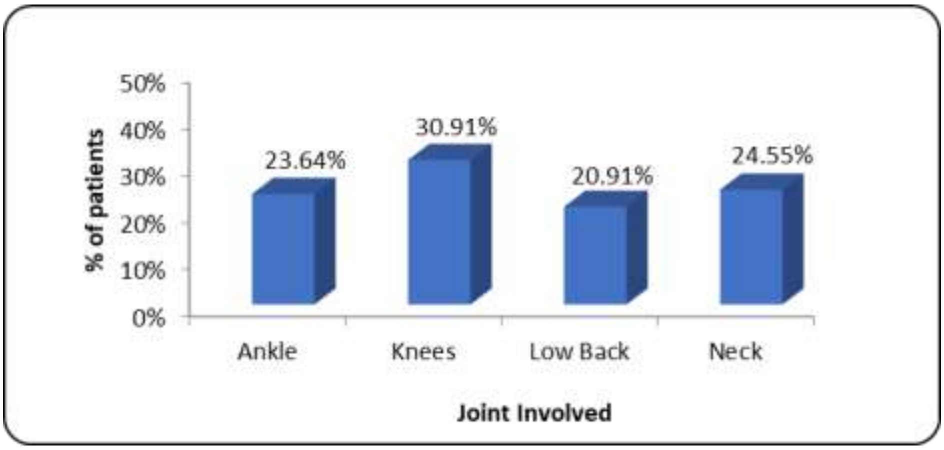

Figure 5: Distribution of study participants according to Joint Involved

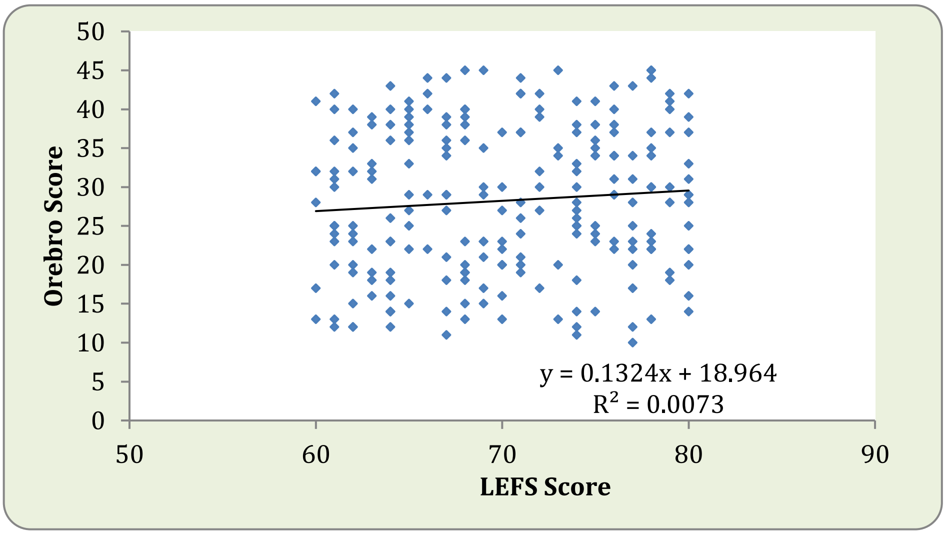

Figure 6: Correlation between LEFS score and Orebro score

DISCUSSION

The present study investigated the prevalence of musculoskeletal disorders among sprinters and examined functional limitations, pain-related disability, and psychosocial risk factors. The findings revealed that knee involvement was the most common musculoskeletal complaint, with the majority of participants being young sprinters (18–27 years) engaged predominantly in short-distance sprinting (<100 m). These findings are consistent with recent evidence highlighting the high burden of lower-extremity injuries in running and sprint-based sports.

Contemporary literature suggests that lower limb injuries, particularly around the knee joint, remain highly prevalent among track and field athletes, largely due to repetitive high-impact loading and biomechanical stress during sprinting phases (Dande V, 2024). Sprinting requires rapid force production, high stride frequency, and significant ground reaction forces, which disproportionately load the knee joint during acceleration and maximal velocity phases. A recent meta-analysis on sprint biomechanics (Pietraszewski, 2025) further emphasizes that neuromuscular demands and altered muscle activation patterns, especially under fatigue, significantly increase stress across the knee and surrounding structures (Pietraszewski, 2025). This supports the current study's finding that the knee is the most vulnerable joint in sprinters.

The predominance of athletes participating in short sprint distances (<100 m) in this study is clinically relevant. Short-distance sprinting is characterized by explosive acceleration and maximal force output, which are strongly associated with acute musculoskeletal stress. Recent research indicates that such high-intensity efforts increase the likelihood of tissue overload, particularly in the knee and hamstring complex (Bramah, 2024). Although hamstring injuries are frequently reported in sprinting, the kinetic chain involvement suggests that knee joint stress may be equally significant due to its central role in force transmission and shock absorption.

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The demographic profile of the study, with a mean age of 26.42 ± 4.95 years and predominance of younger athletes, aligns with current epidemiological data suggesting that injury incidence is higher in active, competitive age groups due to increased training volume and intensity. A recent prospective cohort study (Bramah, 2024) highlights that biomechanical factors such as muscle strength imbalance, altered joint alignment, and inadequate neuromuscular control significantly contribute to injury risk in this population (Moreira, 2024). These findings reinforce the importance of screening programs, such as those used in the present study, for early identification of risk factors.

Another important observation in the present study is that females slightly outnumbered males. While gender-specific injury analysis was not performed, recent literature suggests that female athletes may exhibit a higher susceptibility to certain lower extremity injuries due to differences in neuromuscular control, joint kinematics, and hormonal influences. Emerging evidence in sports medicine indicates that these intrinsic factors, combined with training load and environmental conditions, contribute to increased knee injury risk among female athletes, particularly in high-intensity sports.

Interestingly, the study found no significant correlation between functional ability (LEFS) and pain-related disability (Orebro score). This finding aligns with recent research indicating that pain perception and functional performance are not always directly correlated in athletic populations. Athletes often maintain performance despite experiencing pain, influenced by psychological resilience, motivation, and adaptation to chronic load. A recent scoping review reported that injury incidence and functional impairment do not consistently correlate with biomechanical subgroups, suggesting that injury experience is multifactorial and influenced by both physical and psychosocial variables (Adamson, 2024).

The lack of association between pain and function also highlights the role of psychosocial factors, which are increasingly recognized in sports injury research. Fear of re-injury, stress, and psychological readiness can influence both reporting of pain and perceived disability. Although the present study utilized the Orebro questionnaire, a more in-depth analysis of psychosocial variables could provide further insight into this complex relationship.

From a clinical perspective, these findings emphasize the need for comprehensive, multidimensional screening approaches in sprinters. Prevention strategies should not only focus on physical parameters such as strength, flexibility, and biomechanics but also incorporate neuromuscular training and psychological assessment. Recent advancements also suggest the potential use of motion analysis and technology-assisted screening to detect abnormal movement patterns associated with knee injuries.

However, this study has limitations. The observational design limits causal inference, and reliance on self-reported measures may introduce reporting bias. Additionally, the lack of detailed biomechanical assessment restricts the ability to identify specific injury mechanisms. Future research should incorporate longitudinal designs and objective biomechanical analysis to better understand injury causation.

CONCLUSION

In conclusion, the present study supports current evidence that knee injuries are highly prevalent among sprinters, particularly in young athletes engaged in high-intensity, short-distance events. The absence of correlation between pain and functional limitation underscores the complex interaction between physical and psychosocial factors. These findings highlight the importance of targeted injury prevention strategies and comprehensive screening protocols in sprinting populations.

RECOMMENDATIONS

This study emphasizes the importance of routine musculoskeletal screening in sprinters for early detection of injuries and functional limitations. It supports the use of targeted, sport-specific prevention and rehabilitation strategies, along with consideration of psychosocial factors in recovery. The findings also highlight the need for individualized training and load management, especially in non-elite settings, to reduce injury risk and improve athletic performance. Future studies can expand on these findings by including larger and more diverse populations across different regions to improve generalizability. Longitudinal research is needed to track progression of musculoskeletal problems and establish cause-effect relationships. Interventional studies can be conducted to evaluate the effectiveness of specific injury prevention programs in sprinters. Further research may also compare injury patterns between sprinters and other types of athletes to identify sport-specific risks.

LIMITATIONS

Participants were self-selected volunteers, which may cause selection bias. Clinical screening findings were not confirmed with imaging or instrumented biomechanical analysis, which may affect diagnostic accuracy. Injury history and training load were self-reported and subject to recall bias.

Ethics Statements Ethical approval was obtained from the institutional ethics committee Bharati Vidyapeeth (Deemed to be University) Medical College and Hospital, Sangli prior to the commencement of the study. Participation was voluntary, and the participants were assured of anonymity and confidentiality. All procedures were conducted in accordance with the ethical standards for research involving human participants.

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Conflict of Interest

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