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Run Smart, Run Strong: Exploring the Role of Physiotherapy in Running Load Management and Injury Prevention among Recreational Runners

Ruchita Govind Handore[1], Aditi Anil Davane[2], Dr Shashwat Joshi[3], Dr Priyaranjan Chaudhary[4]

[1,2]3rd Year Bpt Student Ideal Instute Of Physiotherapy, Ideal Institute Of Physiotherapy , Palghar 421303
[3]Assistant Professor Ideal Instute Of Physiotherapy, Ideal Institute Of Physiotherapy , Palghar 421303
[4]Professor Ideal Instute Of Physiotherapy, Ideal Institute Of Physiotherapy , Palghar 421303

ABSTRACT

Background: Running is a widely practiced form of physical activity among recreational runners; however, inappropriate training load and inadequate progression may contribute to running-related injuries. Physiotherapy may play an important role in optimizing running load, improving physical capacity, and preventing running-related injuries through strengthening, flexibility, neuromuscular, and load-management strategies. Therefore, this narrative review aimed to explore the role of physiotherapy in running load management and injury prevention among recreational runners.

Methodology: A narrative review was conducted using literature identified from **PubMed and Google Scholar**. The search strategy incorporated keywords related to running, recreational runners, running load, training load, running-related injuries, injury prevention, and physiotherapy using Boolean operators such as **AND** and **OR**. Studies were screened according to predefined inclusion and exclusion criteria. Randomized controlled trials involving recreational or novice recreational runners and investigating running load, training interventions, injury prevention, or related functional outcomes were considered. Data regarding study methodology, participants, interventions, outcome measures, and major findings were extracted and synthesized narratively.

Results: Six studies were included in the final narrative synthesis. The findings demonstrated that structured exercise interventions can positively influence several outcomes in recreational runners. A multi-component exercise programme significantly reduced overall running-related injuries and overuse injuries. Lower-leg exercises improved quality of life and foot posture in runners with medial tibial stress syndrome, although significant improvements in pain and injury severity were not observed. HIIT and plyometric training improved agility, lower-limb power, sprint speed, and functional performance. Training intensity distribution was also associated with endurance performance. However, hip/core and ankle/foot interventions produced only small biomechanical changes without clinically meaningful improvements in running kinematics or strength. One included study was a protocol comparing moderate- and high-load exercise for Achilles tendinopathy and therefore did not provide clinical outcome data.

Conclusion: The available evidence suggests that physiotherapy-based exercise and appropriate training-load management may contribute to injury prevention and improved physical and functional outcomes in recreational runners. However, the relationship between running load and injury is complex and cannot be explained by a single training variable. Individual factors, training progression, physical capacity, strength, and biomechanics should be considered when developing physiotherapy-based running programmes. Further high-quality studies using standardized measures of running load and running-related injury are required to establish clearer evidence-based recommendations.

Keywords: Recreational runners; Running load; Training load; Running-related injuries; Physiotherapy; Injury prevention; Exercise therapy; Load management; Running injuries.

INTRODUCTION

Health guidelines globally emphasize the importance of participating in regular, moderate, to vigorous physical activity to sustain overall physical well-being [1, 2]. Compared to alternative high-intensity sports, running is particularly appealing as it eliminates major barriers to maintaining an active lifestyle [3]. Running has emerged as one of the most widely practiced forms of exercise worldwide, gaining substantial popularity due to its minimal equipment requirements, low cost, and clear cardiovascular benefits [4]. Despite the clear health benefits of exercise, long-distance running carries a high risk of lower extremity injuries with reported incidence rates ranging from 19.4% to 79.3% [5, 6]. Among these conditions, the knee joint is consistently identified as the primary and most frequent site of injury, followed by the lower leg and Achilles tendon [5, 7]. Furthermore, evidence highlights that sudden increase in weekly running distance and a history of previous musculoskeletal injuries serve as significant risk factors for sustaining new injuries [5]. Running-related overuse injuries primarily result from low-magnitude repetitive mechanical stress accumulated over numerous stride cycles [8, 9]. Understanding the etiology of running-related injuries requires an evaluation of training load management [10]. As highlighted in International Olympic Committee consensus statement, poor load management serves as a primary risk factor for sports-related injuries [11]. Injury often stems from an imbalance between external physical loads and internal tissue load-bearing capacity [9, 10]. When training progression exceeds recovery, it leads to maladaptation, prolonged tissue fatigue, and structural damage [9, 10]. Furthermore, internal load response is influenced not only by physical parameters but also by psychological stressors and daily fatigue, emphasizing the need to monitor both internal and external training factors in injury prevention protocol [11, 12]. Recreational runners represent a distinct target population whose injury profile differs significantly from competitive and elite athletes [13]. Literature emphasizes that injury risk is strongly correlated with exposure time—measured as injuries per 1000 hr of running and varies across different categories of runners due to differences in training behaviors and load tolerance [13]. Inadequate rest days between training sessions hinder muscle recovery, leading to cumulative micro-trauma in recreational runners [14]. Unlike elite athletes, recreational runners often engage in running without structured coaching, formal strategies, consequently unmanaged variations in running load and exposure hours place this specific population at a heightened risk for lower extremity overuse injuries [13, 14]. Novice recreational runners face a substantially higher incidence of lower limb injuries compared to experienced recreational runners [15]. The overall stress response of biological tissue is jointly governed by internal factors (including genetics & lifestyle) and external mechanical forces defined by load magnitude, rate & duration [9]. Furthermore, alteration in lower extremity running biomechanics can introduce abnormal, repetitive strain on periarticular soft tissues over time; these atypical loading patterns significantly elevate the clinical risk of lower limb overuse injuries, most notably Achilles tendinopathy, iliotibial band syndrome, plantar fasciitis, and posterior tibial tendon dysfunction [16]. Inappropriate shoe selection and abrupt changes in running footwear mechanics alter impact loading patterns, elevating injury vulnerability in non-professional runners [22]. Running on overly rigid surfaces without proper midsole cushioning accentuates joint impact forces, accelerating soft tissue fatigue in recreational runners [23]. Beyond purely mechanical variables, intrinsic psychophysiological factors play a critical role in injury susceptibility [12, 17]. According to the stress-injury model, stress response significantly impairs attentional focus and muscle tension control [12]. Consequently, elevated psychological stress and physical fatigue compromise movement coordination, thereby predisposing recreational runners to cumulative tissue breakdown [17]. Additionally, insufficient sleep and inadequate recovery periods further impair tissue repair mechanisms [18].

Although existing literature extensively addresses general injury mechanics, there is a distinct lack of systemic evidence evaluating standardized injury incidence across different runner categories using exposure-based metrics [13]. Most findings derived from competitive distance runners cannot be directly applied to non-elite populations, given the marked differences in physical conditioning, training regularity, and lifestyle-related stress [13]. Furthermore, limited clinical research explores how specific internal and external workload variables directly correlate with lower extremity overuse injuries in local recreational runners [10, 11]. This lack of population-specific baseline data creates a clear research gap, emphasizing the need for targeted clinical investigations in non-elite running cohorts.

Therefore, the primary aim of this study is to evaluate the as physiotherapy for running load parameters—specifically monitoring external volume and internal workload fluctuations—and the incidence of lower extremity overuse injuries among recreational runners. Monitoring both external volume and internal workload is crucial in injury prevention, as excessive training load and unmanaged fatigue are strongly correlated with an increased incidence of soft-tissue overuse injuries [19]. Establishing population-specific workload metrics is essential to identify clinical risk thresholds in non-elite cohorts [20].

METHODOLY

The present study will be conducted as a narrative review of randomized controlled trials (RCTs) to investigate the physiotherapy managemet for running load and running-related injuries among recreational runners. The methodology will be structured according to established principles for narrative reviews, with a predefined search strategy, eligibility criteria, study selection, data extraction, and methodological quality assessment.

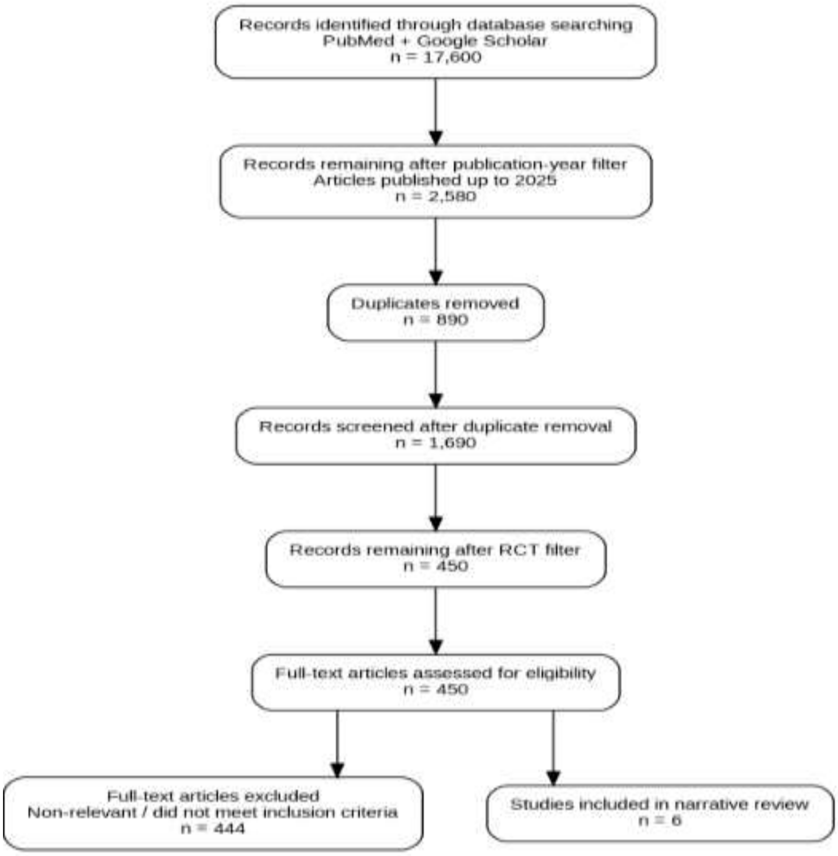
The databases will be searched from their inception to the date of the final search. The search strategy will use combinations of keywords and Medical Subject Headings (MeSH), where applicable.

Boolean operators AND, OR, and NOT will be used to combine search terms and improve the sensitivity and specificity of the literature search.

Boolean Search Strategy

The following search strategy may be used in PubMed:

("Running"[MeSH Terms] OR running OR jogging OR "distance running" OR "recreational running") AND *("recreational runner" OR runner* OR jogger* OR "recreational athlete”



Main Findings

1	**Lower-leg exercises added to multimodal treatment for medial tibial stress syndrome (MTSS) in recreational runners**	Randomized controlled trial. **n = 40** recreational runners with MTSS; randomly allocated to intervention (n=20) and control (n=20). Both received ice massage, foot orthoses and extracorporeal shockwave therapy. The intervention group additionally received tailored lower-leg exercises including stretching, strengthening, sensorimotor exercises and foam-roller myofascial release. Assessments were performed at baseline, 6 weeks and 12 weeks.	Pain intensity; MTSS severity; perceived treatment effect; quality of life (QoL); static foot posture index (FPI); dynamic arch index (DAI).	No significant between-group differences in pain intensity (**P=.17**) or MTSS severity (**P=.30**). The intervention group showed significant improvements in QoL (**P=.003**), static FPI (**P=.02**) and DAI (**P<.001**). At 6 and 12 weeks, DAI was lower in the intervention group. At 12 weeks, QoL was significantly higher and FPI significantly lower compared with controls.
2	**Polarized and pyramidal training intensity**	**18 recreational-level triathletes** were divided into polarized (POL) and	Training intensity distribution; swimming, cycling	Zone 2 training time was inversely correlated with swimming and cycling race

	distribution and performance in Half-Ironman triathlon	pyramidal (PYR) training groups. Training intensity was classified into 3 zones based on ventilatory thresholds: Zone 1 (<VT1), Zone 2 (VT1–VT2) and Zone 3 (>VT2). Running, cycling and swimming training were quantified according to cumulative time in each zone.	and running times; total Half-Ironman race time; power/speed at VT2; maximum aerobic power and speed.	race time in POL and with running and total race time in PYR. Power at VT2 and speed at VT2 were also inversely associated with race performance. The findings suggested that greater Zone 2 training time was related to better Half-Ironman performance in amateur triathletes.
3	**Moderate-load versus high-load exercise intervention for Achilles tendinopathy in runners**	Randomized controlled trial **protocol** involving 60 amateur runners with Achilles tendinopathy. Participants were to be randomized into high-load exercise (HLG) or moderate-load exercise (MLG). HLG would progressively increase calf exercise from 55% to 90% 1RM over 12 weeks, while MLG would maintain 55% 1RM. Total training volume and tendon time under tension would be matched. Quadriceps and gluteal strengthening would also be performed.	Primary outcome: **VISA-A (Victorian Institute of Sport Assessment–Achilles)**. Outcomes assessed at baseline, week 6 and week 12. The abstract also identifies pain, symptom severity, QoL, muscle strength and function as study outcomes.	**No results were reported in the provided abstract because this is a study protocol.** The study was designed to determine whether high-load exercise produces greater effects than moderate-load exercise in runners with Achilles tendinopathy.
4	**High-Intensity Interval Training (HIIT) versus plyometric training in recreational runners**	Randomized controlled trial involving **60 recreational runners**, allocated to HIIT, plyometric training or control groups. Supervised sessions were performed **3 times/week for 6 weeks**. Outcomes were assessed at baseline, week 3 and week 6.	Agility – T-test; lower-limb power – vertical jump test; sprint speed – 50-m sprint; functional performance – Figure-8 Hop Test.	Both HIIT and plyometric training produced significant improvements compared with control (**P<.001**) across the measured performance outcomes. No statistically significant differences were found between HIIT and plyometric groups (**P>.05**). Both interventions were therefore effective for improving performance in recreational runners.

5	**Online multi-component exercise programme for prevention of running-related injuries (RRIs) in recreational runners**	Randomized controlled trial involving **264 recreational runners**: intervention (n=135) and control (n=129). Intervention consisted of 11 exercises targeting core strength, flexibility and neuromuscular control, performed 2–4 times/week for 15–30 minutes. Control participants continued their usual running routine. Injuries were self-reported every 2 weeks over **9 months**.	Running-related injury incidence; overall RRI rate; overuse injury rate; acute injury rate; incidence rate ratio (IRR).	**30.3%** of participants reported at least one new injury. Overall injury incidence was **6.52 injuries/1,000 running hours**. The intervention group had significantly lower overall RRI rates (**4.62 vs 8.71/1,000 h; IRR=0.53, 95% CI 0.37–0.77; P=.004**) and overuse injury rates (**4.04 vs 7.61; P=.001**). This represented approximately **47% reduction in overall RRI and 54% reduction in overuse injuries**. No significant difference was observed for acute injuries.
6	**Effects of hip/core versus ankle/foot strength and neuromuscular training on running kinematics and strength in novice recreational runners**	Three-arm randomized controlled trial. The study included **178 runners in the analysis** (131 female, 47 male), with participants randomized to Hip and Core, Ankle and Foot, or control/static-stretching groups. Intervention period was **6 months**, with exercises performed before an identical running programme. Over-ground 3-dimensional running kinematics, ground-reaction forces and isokinetic lower-limb strength were assessed before and after intervention.	3-D running kinematics; ground reaction forces; isokinetic hip, knee and ankle strength; hip internal/external rotation; ankle plantarflexion, dorsiflexion and inversion strength.	No significant between-group differences were found in strength. Ankle plantarflexion, dorsiflexion and inversion strength increased within groups. Small kinematic changes were observed in hip rotation variables. However, changes were **less than 2°**, and the authors considered the clinical effect small/negligible. Overall, hip/core and ankle/foot interventions did not produce clinically meaningful changes in running kinematics or strength

RESULT

The six included studies demonstrated varied effects of training load and exercise interventions among recreational runners. **Article 1** found that adding lower-leg exercises to multimodal treatment significantly improved quality of life and static and dynamic foot posture, but did not significantly reduce pain or MTSS severity. **Article 2** reported that greater Zone 2 training time was associated with better Half-Ironman performance in recreational triathletes. **Article 3** was a study protocol comparing moderate- and high-load exercise for Achilles tendinopathy; therefore, no results were available. **Article 4** showed that both HIIT and plyometric training significantly improved agility, lower-limb power, sprint speed, and functional performance compared with controls, with no significant difference between the two interventions. **Article 5** demonstrated that a multi-component exercise programme significantly reduced overall running-related injuries and overuse injuries, with no significant effect on acute injuries. **Article 6** found that hip/core and ankle/foot interventions produced only small changes in running kinematics and no clinically meaningful between-group differences in strength or running biomechanics.

DISCUSSION

The present review examined the available evidence regarding running load, training characteristics, and running-related outcomes in recreational runners. Overall, the included studies suggest that structured training and exercise interventions can influence injury occurrence, physical performance, quality of life, and running biomechanics, although the effects varied between studies.

The strongest evidence related to injury prevention was observed in the study evaluating an online multi-component exercise programme. The intervention significantly reduced overall running-related injuries and overuse injuries compared with usual running practice. This suggests that regular strengthening, flexibility, and neuromuscular exercises may help reduce injury risk in recreational runners. However, no significant reduction was observed in acute injuries, indicating that exercise programmes may be more effective in addressing factors associated with gradual overuse injuries than sudden injuries.

The study involving hip/core and ankle/foot interventions found only small changes in running kinematics and no clinically meaningful improvements in strength between groups. This indicates that changes in strength or biomechanics do not necessarily translate into meaningful changes in running-related outcomes. Similarly, the MTSS study found improvements in quality of life and foot posture following lower-leg exercises but no significant improvement in pain or MTSS severity. These findings demonstrate that exercise interventions may improve functional or biomechanical factors without necessarily reducing symptoms.

The HIIT and plyometric training study showed that both training approaches improved agility, lower-limb power, sprint speed, and functional performance, with no significant difference between the interventions. Although these findings demonstrate improvements in physical performance, they cannot directly establish a reduction in running-related injury risk.

The study investigating training intensity distribution suggested that the amount of training performed at moderate intensity was associated with better Half-Ironman performance. However, because the participants were recreational triathletes and injury was not the primary outcome, its findings should be interpreted cautiously when applied to recreational runners. The Achilles tendinopathy study was a protocol and therefore did not provide outcome findings.

Overall, the findings indicate that **running load should not be considered as a single factor**. Training intensity, volume, exercise capacity, strength, biomechanics, and training progression may interact to influence running-related outcomes. However, differences in study populations, interventions, outcome measures, and definitions of injury limit direct comparison between studies. Further research using standardized measures of running load and clearly defined running-related injuries is required to establish more specific recommendations for recreational runners.

CONCLUSION

The present review concludes that running load and structured exercise interventions may influence running-related outcomes in recreational runners. The included studies showed beneficial effects on injury prevention, physical performance, quality of life, and selected biomechanical factors. Multi-component exercise programmes appeared particularly useful in reducing overall and overuse running-related injuries. However, the evidence remains inconsistent, and the relationship between running load and injury cannot be explained by a single training variable. Factors such as training intensity, volume, progression, strength, biomechanics, and individual characteristics may collectively influence injury risk. Therefore, appropriate load management combined with individualized strengthening and neuromuscular training may be beneficial for recreational runners.

Further high-quality studies with larger samples, standardized definitions of running load and injury, and longer follow-up periods are required to establish clearer recommendations regarding safe running-load progression and prevention of running-related injuries.

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