Proprioception and Landing strategy recovery in recreational runners following a half-marathon

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Summary

The rising popularity of half-marathons has increased running-related injuries, often linked to lower extremity biomechanics and inadequate recovery. This study investigated acute changes and recovery in proprioception and landing strategies in recreational runners after a simulated treadmill half-marathon.

Significant increases in knee ($p<0.001$) and hip ($p<0.001$) angular errors were observed immediately post-run. Contact time increased ($p=0.028$), while peak vertical ground reaction force ($p=0.001$) and impulse ($p=0.002$) decreased during the stance phase. Most parameters recovered within one day, except hip joint position sense, which normalized by day two. Running a half-marathon temporarily alters proprioception and landing strategies, with recovery within two days. These findings aid in optimizing training and preventing overtraining in recreational runners.

Introduction

Participation in the Berlin half-marathon surged more than sevenfold from 1990 to 2023, accompanied by a rise in running-related musculoskeletal injuries, with a prevalence of 44.6% ± 18.4% [1]. Most injuries are overuse-related, as runners accumulate over 12,600 repetitive foot strikes during a half-marathon [2]. This repetitive activity induces fatigue, impairing neuromuscular control and mechanical stability, thereby increasing injury risk. Research links biomechanical factors to such injuries, showing significant differences in lower extremity kinematics, kinetics, and proprioception among affected runners [3]. Inadequate rest between sessions can lead to injuries and underperformance [4], particularly in recreational runners, who constitute the majority of participants and often lack professional guidance. This study examines acute changes and recovery patterns in Proprioception (knee and hip joint position sense) and landing strategies (peak force, contact time and impulse) of recreational runners following a simulated half-marathon.

Methods

Thirty-six recreational runners were recruited. Neuromuscular function and landing strategies were assessed pre-run, immediately post-run, and at 1 and 2 days post a simulated treadmill half-marathon. Proprioception was assessed with joint angle reproduction tasks using reflective markers. Kinematics and kinetics were recorded with an eight-camera system and instrumented treadmill at a fixed speed of 10 km/h. Ground reaction forces and angular errors were analyzed using Visual3D software. Repeated-measures ANOVA was used for statistical comparisons ($p < 0.05$).

Results and Discussion

We observed an increase in both the absolute angular errors (the absolute difference between the target angle and the replicated angle) of the knee ($p<0.001$) and hip ($p<0.001$) following the half-marathon (Fig. 1). Additionally, contact time increased ($p=0.028$) while peak vertical ground reaction forces ($p=0.001$) and impulse ($p=0.002$) decreased post-half-marathon (Fig. 1).

No significant differences were observed in knee angular error one or two days post-half-marathon compared to baseline measurements. However, hip angular error ($p=0.037$) increased one day post-run but returned to baseline by day two (Fig. 1). No significant differences were detected in peak vertical ground reaction forces, impulse, and contact time, at one day or two days post-half-marathon compared to pre (Fig. 1).

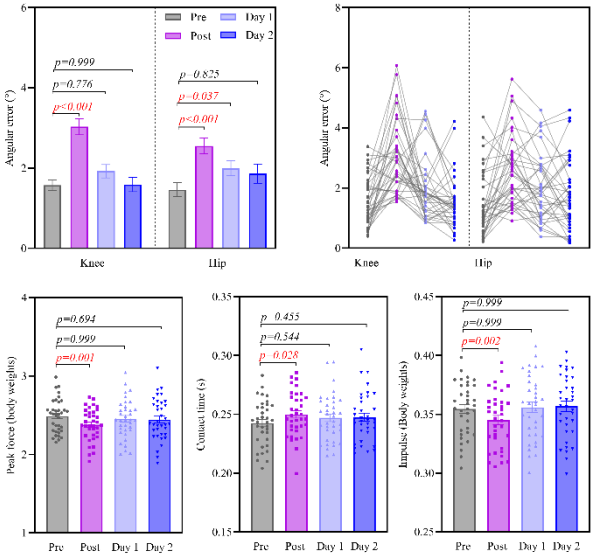

Figure 1: Biomechanical changes following a half-marathon.

Conclusions

Overall, our findings indicate that a simulated treadmill half-marathon temporarily alters proprioception and landing strategies, potentially increasing injury risk. These effects resolve within two days. Investigating acute biomechanical changes and recovery times is crucial to optimizing training and preventing overtraining in runners.

References

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