



Effectiveness of Plyometric Training Versus Pilates Training on Explosive Muscle Strength and Running Performance in Recreational Marathon Runners

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Abstract

Background: Endurance performance in marathon runners depends not only on aerobic conditioning but also on neuromuscular efficiency, muscular power, and postural control. Supplemental exercise programs such as plyometric and Pilates training may improve running economy and athletic performance.

Objective: To compare the effects of plyometric training and Pilates training on explosive muscle strength and running performance in recreational marathon runners.

Methods: A comparative experimental study was conducted among 70 recreational marathon runners aged 18-45 years. Participants were allocated into two intervention groups: plyometric training (n=35) and Pilates training (n=35). Both groups followed supervised training protocols for six weeks. Outcome measures included the 20-meter sprint test and the 5-kilometer run test. Statistical analysis was performed using paired and independent t-tests.

Results: Significant improvement was observed in both groups after intervention ($p<0.05$). The plyometric training group demonstrated greater improvement in sprint performance and running efficiency compared with the Pilates group. Mean sprint time improved from 3.36 ± 0.12 sec to 3.07 ± 0.12 sec in the plyometric group and from 3.35 ± 0.13 sec to 3.12 ± 0.13 sec in the Pilates group. The 5-km run performance also improved in both groups.

Conclusion: Both training methods were beneficial for recreational marathon runners; however, plyometric training produced comparatively superior gains in explosive strength and running performance. Pilates training remained effective for improving core stability and movement control.

Keywords: Plyometric Training; Pilates Training; Marathon Runners; Running Performance; Explosive Strength

Introduction

Marathon running requires a combination of cardiovascular endurance, muscular efficiency, biomechanical stability, and neuromuscular coordination. Although aerobic conditioning remains the primary component of marathon preparation, recent studies have highlighted the importance of strength-based supplementary training programs in improving athletic performance and reducing injury risk.

Plyometric exercises involve rapid eccentric and concentric muscle contractions using the stretch-shortening cycle. These exercises improve force production, neuromuscular activation, and lower-limb power, which may enhance stride mechanics and running economy. Previous investigations have reported positive effects of plyometric interventions on endurance running performance and sprint ability.

Pilates training focuses on postural alignment, flexibility, breathing control, and activation of deep stabilizing muscles. Improved core stability may contribute to better movement efficiency during prolonged running activity and may reduce compensatory movement patterns associated

with fatigue.

Despite the growing popularity of both training approaches, comparative evidence regarding their effectiveness in recreational marathon runners remains limited. Therefore, the present study aimed to compare the effectiveness of plyometric and Pilates training on explosive muscle strength and running performance.

Aim

To compare the effectiveness of plyometric training and Pilates training on explosive muscle strength and running performance in recreational marathon runners.

Materials and Methods

Study design: Comparative pre-test and post-test experimental study.

Study setting: Department of Physiotherapy, Malla Reddy University, Hyderabad

Sample size: Seventy recreational marathon runners.

Duration: Six-week intervention period.

Inclusion criteria:

1. Participants aged between 18 and 45 years.
2. Recreational marathon runners with regular endurance training.
3. Completion of at least one marathon within the previous 12 months.

Exclusion criteria:

1. Musculoskeletal or neurological disorders affecting performance.
2. Current participation in structured strength programs.
3. Non-compliance with the intervention protocol.

Outcome measures:

- 20-meter sprint test
- 5-kilometer run test

Procedure: Participants were divided into two groups. Group A underwent a supervised plyometric training protocol, while Group B participated in Pilates-based exercises. Training sessions were conducted regularly over six weeks in addition to routine endurance activity. Baseline and post-intervention assessments were recorded using standardized procedures.

Results

Both groups demonstrated statistically significant improvement after six weeks of intervention. The plyometric group showed greater enhancement in sprint performance and running efficiency compared with the Pilates group.

In the plyometric training group, the mean 20-meter sprint time improved from 3.36 ± 0.12 seconds to 3.07 ± 0.12 seconds. The 5-kilometer run time improved from 24.98 ± 1.65 minutes to 22.31 ± 1.28 minutes.

In the Pilates training group, the mean sprint time improved from 3.35 ± 0.13 seconds to 3.12 ± 0.13 seconds, while the 5-kilometer

run time improved from 25.57 ± 0.70 minutes to 23.49 ± 0.75 minutes.

Between-group analysis indicated better overall improvement in the plyometric training group.

Discussion

The findings of the present study suggest that both plyometric and Pilates training can positively influence running performance in recreational marathon runners. The greater improvement observed in the plyometric group may be associated with enhanced neuromuscular recruitment, increased lower-limb stiffness, and improved force generation during running.

Earlier investigations have also demonstrated that plyometric exercises improve explosive strength and running economy by optimizing the stretch-shortening cycle. Conversely, Pilates training appears to enhance trunk stability, postural control, and movement efficiency, which may indirectly improve endurance performance.

The present findings support the integration of supplementary conditioning programs into conventional marathon training. Combining endurance exercise with neuromuscular and core-stability training may contribute to improved athletic performance and reduced injury incidence.

Conclusion

Both plyometric training and Pilates training improved explosive muscle strength and running performance in recreational marathon runners. However, plyometric training produced comparatively greater improvements in sprint ability and running efficiency. Pilates training also demonstrated beneficial effects related to stability and movement control. Incorporating structured supplementary exercise programs may therefore be advantageous for endurance athletes.

Limitations

The study was limited by the short intervention duration and recruitment from a single center. Future studies with larger sample sizes and longer follow-up periods are recommended.

Conflict of Interest

The authors declare that there is no conflict of interest related to this study.

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