Effects of Half-Marathon Running on Quadriceps and Hamstring Torque

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Summary

The purpose of this study is to assess changes in concentric and eccentric quadriceps and hamstring torque following half-marathon running on the treadmill. Thirty-eight recreational runners were recruited to measure muscle strength before and 5 minutes after completing half-marathon. A significant decrease in concentric and eccentric torque were observed at 5 minutes after a half-marathon for both hamstrings (all $p < 0.001$) and quadriceps (all $p < 0.001$). Compared to female runners, concentric hamstrings ($p = 0.003$) and quadriceps ($p = 0.002$) torques of male runners show significance.

Introduction

Fatigue increases the risk of athletic injuries, especially muscle injuries. Delaying fatigue can reduce injury occurrence. After a marathon, muscle strength drops significantly due to muscle damage. Studies have found that local eccentric and concentric muscular endurance of the knee flexors helps maintain stride mechanics by delaying fatigue-related kinematic changes during endurance running [1]. Moreover, Some researchers have found that hamstring strength is related to performance in long-distance running [2]. Therefore, knee extensors and flexors strength changes in concentric and eccentric contractions still need more study. Therefore, the aim of this study was to investigate changes in concentric and eccentric quadriceps and hamstring torque before, 5 minutes after running and the change difference between male and female runners.

Methods

Thirty-eight recreational runners (21 female and 17 male) were recruited on a voluntary basis to participate in the study. An Isomed 2000 isokinetic dynamometer was used to measure quadriceps and hamstring torque. Only the right leg underwent testing.

Statistical analysis was conducted using SPSS software. A two-way (gender × time) repeated-measures ANOVA was applied. The significance level was set at $p < 0.05$ for establishing statistical significance.

Results and Discussion

Shapiro-Wilk's test was applied for assessment of normal distribution of data. All data sets ($p > 0.05$) conformed to normal distribution.

The repeated measures ANOVA revealed a statistically significant main effect of time on concentric hamstrings and quadriceps torque (both $p < 0.001$). The most substantial decline in concentric hamstrings and quadriceps torque occurred at 5 minutes after the half-marathon compared to before half-marathon levels (Figure 1). The test of between-subjects effects for concentric hamstrings ($p = 0.003$) and quadriceps ($p = 0.002$) torque revealed a statistically significant gender effect. Additionally, concentric hamstrings ($p = 0.716$) and quadriceps ($p = 0.337$) torque showed no statistically significant interaction effect.

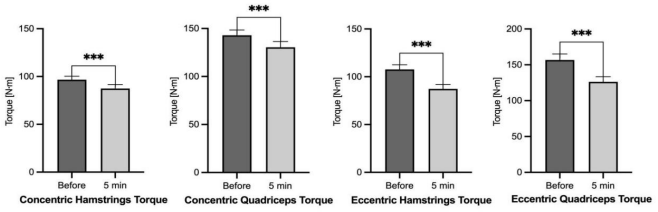

Figure 1: Changes (mean ± SE) in concentric and eccentric quadriceps and hamstring torques before and after a half-marathon. *indicates that torque was significantly smaller/greater after a half-marathon comparison to baseline. SE = standard error.

The results on eccentric hamstrings and quadriceps torque suggested a statistically significant main effect of time (both $p < 0.001$). Eccentric hamstrings and quadriceps torque exhibited significant decreases to 87.37 ± 4.55 N · m, respectively, 5 minutes after the half-marathon (Figure 1). The test of eccentric hamstrings ($p = 0.094$) and quadriceps ($p = 0.142$) torque revealed no statistically significant for gender. No statistically significant differences in eccentric hamstrings ($p = 0.989$) and quadriceps ($p = 0.863$) torque were observed in the interaction effect.

Conclusions

Both quadriceps and hamstring torques decrease in concentric and eccentric contractions after a half-marathon. These findings suggest that improving muscle strength helps to decrease athletic injuries in half-marathon by reducing or delaying fatigue. However, considering the limitations of this experiment, more research is still needed to obtain further results.

References

[1] Hayes, P. R. et al.(2004). *J STRENGTH COND RES*, ***18***(4): 898–903.

[2] Thomas, T. R. et al. (1983). *BRIT J SPORT MED*, **17**(2): 102–109.