

ABSTRACT

Running is a physical activity that requires the coordinated effort of several major muscle groups, including the biceps femoris and gastrocnemius. These muscles play an important role in running stability and performance. However, excessive muscle activity can cause fatigue and increase the risk of injury. The purpose of this study was to compare the fatigue levels of the biceps femoris and gastrocnemius muscles in recreational runners using surface electromyography (sEMG) signal measurements and to evaluate the effect of running speed on treadmill muscle activity. Measurements were taken at three speed levels (slow, medium, and fast) using mean absolute value (MAV) and lactate difference value (LDV) parameters. Data were collected through experimental methods and analyzed using a two-way repeated ANOVA to examine the effects of two independent factors on one dependent variable and a paired t-test to compare two conditions within the same subject. Post hoc tests were also performed to identify pairs of groups with significant differences.

Results showed that running speed significantly affected muscle activity, especially in GL and GM. At slow speed, MAV of Biceps Femoris ($p = 0,0431$) and RMS of GL ($p = 0.0236$) showed significant differences. At medium speed, MDF and MnF decreased significantly in GL ($p = 0.0093$) and GM ($p = 0.001$). At fast speed, significant differences were found in RMS (GL, $p = 0.0001$), MDF (GL, $p = 0.0036$; GM, $p = 0.0022$), and MnF (GL, $p = 0.0022$; GM, $p = 0.0032$). Paired T-test showed significant MAV differences between fast and slow speeds for all muscles ($p < 0.05$), and in GL between fast and medium speeds for MDF ($p = 0.0313$) and MnF ($p = 0.0043$). Lactic acid levels showed no significant differences across speeds ($p > 0.05$), indicating LDV is less effective in detecting fatigue. This suggests frequency-based sEMG features are more sensitive to muscle fatigue than metabolic indicators.

Keywords: *Fatigue, Biceps Femoris, Gastrocnemius, sEMG, Paired T-Test, Two-way Repeated ANOVA, Blood Lactate.*