

Comparison of Extensor and Flexor Isokinetic Fatigue Index Values Calculated Using Different Methods

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Abstract

The fatigue index (FI) obtained from isokinetic testing is widely used to evaluate neuromuscular fatigue; however, the lack of standardization in calculation methods may lead to inconsistent interpretations across studies. The aim of this study was to investigate the effects of different FI calculation methods on outcomes and to determine the agreement and interchangeability among these methods. A total of 59 healthy individuals participated in the study. Participants performed a 50-repetition maximal concentric knee flexion-extension test at an angular velocity of 180°/s using an isokinetic dynamometer. FI was calculated using five different methods: the average of the first three and last three repetitions of 50 repetitions (G1), the average of the fourth, fifth, and sixth repetitions and the last three repetitions (G2), the average of the first five and last five repetitions (G3), the average of the first three and last three repetitions of 30 repetitions (G4), and the average of the fourth, fifth, and sixth repetitions and the last three repetitions (G5). Differences between methods were analyzed using repeated-measures ANOVA with Greenhouse-Geisser correction. Pairwise comparisons were performed with Bonferroni adjustment. Agreement and reliability were evaluated using the intraclass correlation coefficient (ICC) and Bland-Altman analysis. A significant main effect of calculation method was found ($p < 0.001$, $\eta^2p = 0.215$). Pairwise comparisons showed that the methods clustered into two distinct groups; no significant differences were observed among G1, G2, and G3 ($p > 0.05$), whereas each of these methods differed significantly from G4 and G5 ($p < 0.05$). High agreement was observed among G1, G2, and G3 methods (ICC = 0.893; 95% CI: 0.841–0.931). Bland-Altman analysis demonstrated minimal systematic bias among these methods. In contrast, the G4 and G5 methods showed systematic bias compared with the other methods. Fatigue index values varied significantly depending on the calculation method used. While the G1, G2, and G3 methods provided similar and reliable results, the G4 and G5 methods systematically produced different outcomes and do not appear to be interchangeable with the other methods. These findings highlight the need for methodological standardization in isokinetic fatigue assessment.

Keywords

Isokinetic fatigue, fatigue index, reliability, muscle performance.