Monopodal postural stability assessment by wireless inertial measurement units through the fast fourier transform

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Abstract
Objectives: (1) To describe the fast Fourier transform (FFT) multijoint as monopodal postural stability measurement in well-trained athletes, (2) to compare the within-subject FFT between laterality, joints, and body segments, and (3) to establish the within- and between-subject relationship between joints. Methods: Twelve national-level basketball players participated voluntarily in this investigation. The participants performed two 60-second repetitions of a monopodal stability test (1 repetition with each lower limb), separated by 3 minutes of active recovery. All tests were recorded by 4 WIMU PRO™ inertial devices located on the ankle, knee, lumbar spine, and thoracic spine. The main variable was total acceleration, where the FFT was applied. Results: The higher instability results were found in the ankle and in the nondominant lower limb (dominant = 1.131 [0.122] a.u. (arbitrary units); nondominant = 1.141 [0.172] a.u). In the body segment analysis, the greater percentage of differences ($\%_{diff}$) were shown between lumbar spine and knee in the dominant ($\%_{diff}$ = −2.989%; d = 0.87) and nondominant ($\%_{diff}$ = −3.243%; d = 0.90) lower limb. Finally, very large between-subjects variability was found in all joints and body segments. Conclusions: The described protocol is proposed for monopodal postural stability assessment, being useful to provide information about the stability of joints and the body segment between joints. Besides, a within-subject analysis is recommended, and the FFT calculation will enable a linear analysis of each test.

Author keywords
Accelerometers
Balance
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