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EFFECT OF A VISUAL DUAL-TASK ON SINGLE-LEG COUNTERMOVEMENT-JUMP IN LOWER-LIMB INJURED PROFESSIONAL SOCCER PLAYERS

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**Experimental Task and Protocol**

Following a warm-up of gradual increase from 100W to 200W biking , participants performed two maximal isometric voluntary contractions (MVIC) of the leg muscles for EMG normalization. Then, participants completed a series of unmeasured single-leg countermovement jump (SLCMJ) trials, three per leg, on a Kistler 3D force plate (model 9260AA6) to familiarize participants with the task, equipment, and instructions. Two series of SLCMJ were performed and recorded after a one-minute rest. Instructions were to jump as high and fast as possible and maintain stability for three seconds upon landing. Under the single-task condition, participants performed the single-leg CMJ on its own, following the specified conditions. In the dual-task condition, the single-leg CMJ (primary task) was paired with a visual challenge (secondary task). For this visual task, participants had to promptly and audibly identify the color (white, red, blue, or yellow) shown on an electronic pod located 3 meters ahead at eye level. The timing of the pod's display was randomized during the jump.

**Data Recordings**

Movement during the SLCMJ was analyzed using kinetic and electromyography (EMG) data. Kinetic data, including vertical ground reaction forces (GRFZ). EMG data from 6 lower-limb muscles by side (vastus medialis [VM], rectus femoris [RF], biceps femoris [BF], semitendinosus [ST], gluteus medius [GM], and medial gastrocnemius [MG]) were recorded using 12-channel Delsys Trigno wireless sensors. Sensor placement followed SENIAM recommendations and signals were filtered using a 10-Hz bandpass filter and a Butterworth filter, then analyzed using EMGworks 4.4 software via Root Mean Square analysis. All recordings were sampled at 1000 Hz.

**EMG Normalization**

EMG activity during the propulsion and landing phases of the SLCMJ series was normalized to MVIC. Two consecutive 5-second MVIC trials, separated by a 30-second rest, were performed for each muscle of both legs before each test session. The highest peak average value obtained during a 0.5-second period within the 5-second contraction was considered MVIC.

**Raw Experimental Variables**

The force plate provided the following spatio-temporal and kinetic variables:

* Pushing phase duration (time to take-off in ms): The time from the onset of vertical ground reaction force variation to foot take-off.
* Peaks of upward vertical ground reaction force (GRFz in N): During the pushing and landing phases.
* Jump height (in cm): Maximal height attained during the SLCMJ, estimated by flight duration.
* Reactive Strength Index Modified (RSI-mod in m/s): Ratio of jump height to time to take-off, indicating lower-limb explosiveness.
* Rate of Force Development (RFD in N/s): During eccentric (RFD Ecc) and concentric (RFD conc) periods of the pushing phase, reflecting lower-limb explosiveness. It can be more nervous with (early, <100ms) or more muscular (late >200ms).
* Vertical ground reaction force at 50 ms after foot landing (in N): Indicates knee injury risk.
* Time to peak vertical ground reaction force during landing: Time from foot landing to peak GRFz (in ms).

EMG variables included peak and mean muscle electrical activity (in %MVC) during both SLCMJ phases, expressed as a percentage of MVIC.

DT = dual task

LR = leg reception

LP = leg pushing

vastus medialis = VM

rectus femoris = RF

biceps femoris = BF

semitendinosus = ST

gluteus medius = GM

medial gastrocnemius = MG

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