Leg stiffness during phases of countermovement and take-off in vertical jump

Artur Struzik*, Jerzy Zawadzki

Abstract: With respect to cyclic movements such as human gait, running or hopping, leg stiffness is a little variable parameter. The aim of this study was to investigate changes in leg stiffness during the phase of countermovement and take-off when performing a single maximum counter-movement jump. Kistler force plates and a BTS SMART system for comprehensive motion analysis were employed in the study. The study covered a group of 12 athletes from university basketball teams. Leg stiffness were calculated in those parts of countermovement and take-off phases where its level is relatively constant and the relationship $F(\Delta l)$ is similar to linear. Mean total stiffness (±SD) in both legs in the countermovement phase amounted to $6.5 \pm 1.5$ kN/m, whereas during the take-off phase this value was $6.9 \pm 1$ kN/m. No statistically significant differences were found between leg stiffness during the countermovement phase and take-off phase in the studied group at the level of significance set at $\alpha = 0.05$. This suggests that the leg stiffness in phase of countermovement and phase of take-off are much similar to each other, despite different function of both phases. Similar to cyclic movements, leg stiffness turned out relatively constant when performing a single vertical jump. Reported also statistically significant correlations between body mass, body height, length of lower limbs and leg stiffness. The stiffness analysed by the authors should be understood as quasi-stiffness because the measurements of $\Delta F(\Delta l)$ were made during transient states where inertia and dumping forces are likely to affect the final result.

Key words: basketball players, counter-movement jump, quasi-stiffness