Repeated sprinting on natural grass impairs vertical stiffness but doesn’t alter plantar loading in Qatari soccer players

Authors
Olivier Girard, Sebastian Racinais, Luke Kelly, Grégoire Millet, Franck Brocherie

Institutions
Aspetar, Qatar Orthopaedic and Sports Medicine Hospital, Doha, Qatar
University of Lausanne, Lausanne, Switzerland
Qatar Football Association, Doha, Qatar

Background: The ability of players to recover and reproduce sprint performance is a crucial fitness component in soccer. In recent years, there has been an exponential interest in the study of neuro-physiological mechanisms limiting performance during repeated-sprint tests, whereas relatively little attention has been given to the biomechanical manifestation of fatigue. Understanding such factors is critical to performance enhancement and injury prevention strategies in soccer.

Aim: This study aimed to determine changes in spring-mass model characteristics, plantar pressures and muscle activity induced by the repetition of sprints in soccer-specific conditions i.e. on natural grass with soccer shoes.

Methods: Thirteen soccer players, members of two under nineteen Qatar Youth League teams, performed 6 x 20m sprints interspersed with 20s of passive recovery. Plantar pressure distribution was recorded via an insole pressure recorder device divided into nine areas for analysis. Stride temporal parameters allowed the estimation of spring-mass model characteristics. Surface electromyographic activity was monitored for vastus lateralis, rectus femoris and biceps femoris muscles.

Results: Sprint time, contact time and total stride duration lengthened from the first to the last repetition (+6.7%, +12.9% and +9.3%; all p<0.05), while flight time, swing time and stride length remained constant. Stride frequency decrease across repetitions approached significance (-6.8%; p=0.07). No main effect of the sprint number nor any significant interaction between sprint number and foot region was found for maximal force, mean force, peak and mean pressure (all p>0.05). Center of mass vertical displacement increased (p<0.01) with time, together with unchanged (both p>0.05) peak vertical force and leg compression. Vertical stiffness decreased (-15.9%; p<0.05) across trials, whereas leg stiffness changes were not significant (-5.9%; p>0.05). Changes in root mean square activity of the three tested muscles over sprint repetitions were not significant.

Conclusion: Although repeated sprinting on natural grass with players wearing soccer boots impairs their leg-spring behavior (vertical stiffness), there is no substantial concomitant alterations in muscle activation levels or plantar pressure patterns.