

Biomechanical Effects on Barbell Back Squat: Barefoot vs. Running Shoes

MADYSON A. RUNGE, SCOTT P. MCLEAN

Kinesiology; Southwestern University; Georgetown, TX

Category: Undergraduate

Advisor / Mentor: McLean, Scott (mcleans@southwestern.edu)

ABSTRACT

Individuals who weight lift recreationally often do so in a variety of different footwear. Understanding how footwear affects squat biomechanics and kinematics is important in order to achieve optimal form, performance, and muscular strength. **PURPOSE:** Analyze how footwear affects the kinematics of a barbell back squat under two footwear conditions, running shoes and barefoot. **METHODS:** Eight experienced weightlifters ages 18-23 with no prior injuries participated in an analysis of a barbell back squat under two footwear conditions, barefoot and running shoes. A multi-repetition max test was conducted during the first session and 3D video analysis was conducted during the second session. Participants lifted 70% of their calculated 1RM for each footwear trial. Two sets of three consecutive squats were performed under each condition in a crossover design. Knee joint ROM and knee joint moments were measured during the squats on a force plate using a 3D motion analysis system (VICON, Nexus). Results were analyzed using a 2-factor (footwear condition x leg) repeated measures ANOVA. **RESULTS:** Nonsignificant footwear condition main effects were found for knee joint ROM ($p = 0.291$; $\eta^2 = 0.129$) and nonsignificant leg main effects were found for knee joint ROM ($p = 0.127$; $\eta^2 = 0.046$). Nonsignificant footwear condition main effects were found for knee joint moments ($p = 0.272$; $\eta^2 = 0.050$) and nonsignificant leg main effects were found for knee joint moments ($p = 0.460$; $\eta^2 = 0.063$). No significant interactions found between footwear condition and leg for knee joint ROM ($p = 0.181$; $\eta^2 = 0.007$) and knee joint moments ($p = 0.839$; $\eta^2 = 0.0005536$). **CONCLUSION:** No knee kinematic differences were observed between squatting barefoot compared to squatting in running shoes. Footwear-induced kinematic changes that were not observed in the ankle or hip might have compensated to allow the knee to perform similarly between conditions. In future research, analysis of hip, knee, and ankle would be beneficial to decrease variability.