

CORRELATIONS BETWEEN PLANTAR PRESSURE AND JOINT KINEMATICS IN FEMALE RECREATIONAL RUNNERS

Janelle A. Cross[1], Fadumo Mohamud[2], Carolyn Meinerz[1], Gerald F. Harris[1,2], Cody Dziuk[1], and Jessica M. Fritz[1,2]

[1]Department of Orthopaedic Surgery, Medical College of Wisconsin, Milwaukee, WI, USA
[2]Joint Department of Biomedical Engineering, Marquette University and Medical College of Wisconsin, Milwaukee, WI, USA

Corresponding Author: Janelle A. Cross, PhD
Email: jacross@mcw.edu
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ABSTRACT

Running provides many health benefits but carries the risk for lower extremity injuries. Previous studies have performed simultaneous assessments of plantar pressure and joint kinematics; however, they have not investigated correlations between these parameters. The goal of this study was to assess relationships between joint kinematics and plantar pressure metrics during stance phase of running. Fifteen female recreational runners participated in this study. Three-dimensional motion analysis and plantar pressure data were collected simultaneously as the subjects ran on an instrumented treadmill. Participants ran at a self-selected speed while maintaining a heart rate (HR) at 70-80% of their maximum HR (max HR = 220 – age). Sagittal and coronal plane motion of the ankle and hip and sagittal plane motion of the knee, along with peak plantar pressure, peak ground reaction force (GRF), force impulse, and pressure impulse were examined. Spearman rho correlation tests were performed to determine correlations among lower extremity joint kinematics and plantar pressure metrics. Positive correlations were found between peak plantar pressure and ankle dorsiflexion, knee flexion, and ankle inversion as well as between running speed and peak GRF. These correlations gave insight into risk factors for injury based on the relationship between plantar pressure metrics and joint kinematics.

Keywords: running, biomechanics, plantar pressure, treadmill, motion analysis

INTRODUCTION

Running is a common form of exercise, providing health benefits such as weight loss, increased endurance, and improved cardiovascular health [1]. However, it also puts runners at risk for a myriad of lower extremity (LE) injuries. Incidence of LE runner injuries range from 19.3% to 79.3%. Multiple risk factors such as training regimen, age, sex, shoe design, and joint biomechanics contribute to the wide range [2, 3]. There have been several studies using simultaneous assessments of plantar pressure and joint kinematics to analyze running biomechanics. These studies examined how joint kinematics and plantar pressures change between different measurement tools, injury groups, running speed, and shoe design [4-12]. Pressure measuring insoles [4] have been proven as valid tools for measurement of vertical ground reaction forces (GRFs) and loading differences in running shoes [8]. They have also been used in the analysis of treadmill versus overground running [10] and to examine influences of speed and cadence in treadmill running [9, 11].

There remains, however, only limited research examining the correlations between plantar pressure parameters and joint kinematics. In a study investigating how pressure distribution is influenced by foot strike pattern in healthy recreational runners, a significant interaction between a rearfoot strike pattern and peak plantar pressure under the heel was found, concluding that rearfoot striking is associated with greater peak plantar pressure at the heel [13]. The goal of this study was to