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### **Barefoot Running: Good for the Soles?**

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#### Introduction

Barefoot running has gained increased media attention in recent years. Proponents of barefoot running tout benefits, such as reduced impact on the joints of the legs, fewer acute and chronic lower-extremity injuries, and improved proprioception.[1-7] They also point to the lower incidence of foot-related injuries with barefoot sports. [8,9] To date, there have been a lack of evidence-based studies in regard to the long-term sequelae, such as osteoarthritis, with running using athletic footwear or bare feet.

#### The Effect of Running Shoes on Lower Extremity Joint Torques

Kerrigan DC, Franz JR, Keenan GS, Dicharry J, Della Croce U, Wilder RP  
PM R. 2009;1:1058-1063

#### Summary

Dr. Kerrigan and colleagues sought to identify the impact of running "shod" (with shoes) compared with running in bare feet on the major joints of the lower extremities. Sixty-eight healthy, young adult runners with no history of musculoskeletal pathology, and without any musculoskeletal injuries at the time the study, were enrolled in this prospective comparison study. Each adult was classified as a "recreational" runner who ran a minimum of 15 miles per week.

The study participants were instructed to run at a controlled running speed after a 3- to 5-minute warm-up period. Participants ran both barefoot and with standardized footwear. For the shod portion of the experiment, the participants were given Brooks Adrenaline™ neutral running shoes. Three-dimensional anatomic positioning was captured by a 10-camera motion analysis system that tracked motion from 16 retroreflective markers placed over specific body parts, such as the pelvis and lower-extremity joints -- including the hip, knee, and ankle. Ground reaction forces were recorded with an AMTI instrumented treadmill with 2 side-by-side force plates. Resultant joint torques in the sagittal, coronal, and transverse planes were then assessed.

Shod running was associated with significantly increased peak torque forces at the hip, knee, and ankle joints. The average results were as follows:

- 54% increased hip external rotation torque (P < .001);
- 36% increased knee flexion torque (P < .001);
- 38% increased knee varus torque (P < .001); and
- 13% increased ankle internal rotation torque (P < .001).

## Viewpoint

There is growing literature delineating the altered running biomechanics with the use of modern athletic footwear compared with bare feet.[10,11] Increased media coverage of this growing trend in recent years has likely contributed to interest in this area. Dr. Kerrigan and colleagues suggested that the increased lower-extremity joint torque forces found in his study may contribute to the long-term risk for osteoarthritis, particularly at the knee and hip. Increased knee flexion and knee varus torques, for example, may contribute to increased repetitive loading on the patellofemoral and medial joint compartments of the knee, respectively. Current evidence, however, has been inconsistent: Although findings of increased hip external rotation torque forces may be in-line with the increased incidence of hip osteoarthritis found in runners, other recent studies have shown a lack of premature progression of knee arthrosis in distance runners.[12-15]

Limitations to the study include the use of noninvasive methods to analyze runners' biomechanics and gait. As a result, joint torque forces were estimates of true intra-articular forces. Foot mechanics for each participant was also not examined. As a result, shoe types were not "optimized" for each individual's particular type of foot. Rather, each person was given footwear that the researchers believed was representative of a typical running shoe.

With the focus of media and research on barefoot vs shod running, it is important to account for the multitude of other factors that can contribute to the development of a runner's injury, including osteoarthritis. Most running-related injuries that prompt patients to seek medical attention can be attributed to a multitude and combination of factors besides footwear. Changes to a runner's training volume and program and a history of prior injuries, for example, have been consistent risk factors for running-related injuries.[16-18] Furthermore, one must weigh the risks, particularly from a safety standpoint when running outside, as well as the practicality of running barefoot against any added benefits.

For now, the debate in regard to barefoot vs shod running continues, and the underlying question of the long-term pathologic sequelae with using athletic footwear compared with bare feet requires further investigation.

## Abstract

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#### Authors and Disclosures

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