

PLANTAR PRESSURE DISTRIBUTION DURING WALKING IN HABITUALLY BAREFOOT POPULATIONS

Roshna E. Wunderlich¹, Kevin G. Hatala², Heather L. Dingwall², Brian G. Richmond^{2,3}

1. Department of Biology, James Madison University, Virginia
2. Center for the Advanced Study of Hominid Paleobiology, Department of Anthropology, The George Washington University, Washington D.C.
3. Human Origins Program, National Museum of Natural History, Smithsonian Institution, Washington D.C.

INTRODUCTION

Considerable evidence suggests that modern footwear influences foot shape, foot function, and possibly foot deformity (e.g. Ashizawa, 1997; Rao *et al*, 1992; Zipfel and Berger, 2007). Understanding fundamental characteristics of foot function during walking as well as human variation in foot function during walking requires examination of individuals who have never worn shoes. The recent discovery of 1.5 million-year-old hominin footprints near Ileret, Kenya offers the opportunity to analyze the earliest development of the human foot but has also highlighted the importance and the paucity of quantitative pedal biomechanics data on humans whose feet have not been influenced by modern footwear. To date, only D'Août *et al* (2009) have quantified plantar pressure distribution in a broad comparison of foot shape and relative foot pressures in a habitually unshod Indians population.

METHODS

We examined plantar pressure distribution in two populations, both unshod or minimally shod, and one population of healthy shod western adults. 28 adults from Mahajoarivo, Madagascar, 19 adults from Ileret, Kenya, and 295 adults from the U.S. walked barefoot across a plantar pressure mat (EMED in Madagascar; RSScan in Kenya) at a self-selected pace. Video was collected for kinematic analysis, and steps were compared within a restricted speed range. Data were compared across groups using ANOVA with Tukey's HSD.

RESULTS AND DISCUSSION

Peak pressures were generally lower in unshod populations than in shod populations. In particular, significantly lower pressures in the medial heel, all metatarsals, and first toe in both unshod populations compared to the shod group. However, differences were also observed between the unshod populations. The unshod Malagasy population exhibited lower lateral heel and lateral midfoot pressures than the unshod/minimally shod Daasanach.

Our data support D'Août *et al* (2009) in demonstrating overall lower peak plantar pressures in

unshod vs. shod populations. In particular, metatarsal and heel peak pressures are reduced in unshod populations. These differences may be due to morphological (soft tissue, foot width (Ashizawa *et al*, 1997; D'Août *et al*, 2009) or kinematic features facilitating the attenuation of high loads (e.g., Lieberman, 2010; Robbins, 1991).

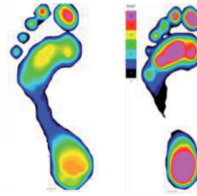


Figure 1: Characteristics peak plantar pressures in (left) habitually unshod individual from southern Madagascar and (right) habitually shod individual from the U.S.

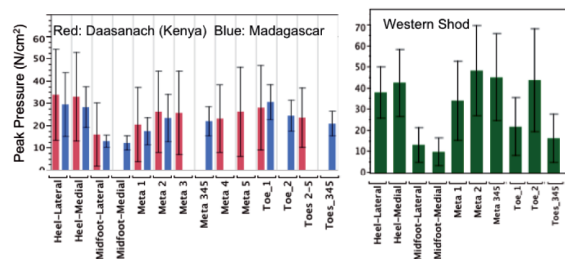


Figure 2: Regional peak plantar pressures in (left) habitually unshod populations from Kenya and Madagascar and (right) shod westerners.

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