



Original article

Comparison of foot strike patterns of barefoot and minimally shod runners in a recreational road race

Peter Larson

Performance Health Spine and Sport Therapy, 91A N. State St., Concord, NH 03301, USA

Received 25 September 2013; revised 4 February 2014; accepted 10 March 2014

Abstract

Background: Previous studies of foot strike patterns of distance runners in road races have typically found that the overwhelming majority of shod runners initially contact the ground on the rearfoot. However, none of these studies has attempted to quantify foot strike patterns of barefoot or minimally shod runners. This study classifies foot strike patterns of barefoot and minimally shod runners in a recreational road race.

Methods: High-speed video footage was obtained of 169 barefoot and 42 minimally shod distance runners at the 2011 New York City Barefoot Run. Foot strike patterns were classified for each runner, and frequencies of forefoot, midfoot, and rearfoot striking were compared between the barefoot and minimally shod groups.

Results: A total of 59.2% of barefoot runners were forefoot strikers, 20.1% were midfoot strikers, and 20.7% were rearfoot strikers. For minimally shod runners, 33.3% were forefoot strikers, 19.1% were midfoot strikers, and 47.6% were rearfoot strikers. Foot strike distributions for barefoot and minimally shod runners were significantly different both from one another and from previously reported foot strike distributions of shod road racers.

Conclusion: Foot strike patterns differ between barefoot and minimally shod runners, with forefoot striking being more common, and rearfoot striking less common in the barefoot group.

Copyright © 2014, Shanghai University of Sport. Production and hosting by Elsevier B.V. Open access under [CC BY-NC-ND license](https://creativecommons.org/licenses/by-nc-nd/4.0/).

Keywords: Barefoot; Biomechanics; Foot strike; Gait; Minimal shoes; Running

1. Introduction

Foot strikes during running are typically classified as either (1) rearfoot, in which initial contact is made somewhere on the heel or rear one-third of the foot; (2) midfoot, in which the heel and the region below the fifth metatarsal contact simultaneously; or (3) forefoot, in which initial contact is made on the front half of the foot, after which heel contact typically follows shortly thereafter.¹ Previous research on foot strike

patterns in road races indicates that the majority of shod distance runners are rearfoot strikers, with percentages ranging from 74.9% of runners in an elite half-marathon race,¹ to 81% of recreational runners in a 10-km race,² to over 90% of recreational runners in marathon distance events^{3,4} (Table 1).

Available research suggests that multiple factors influence the type of foot strike exhibited by a given runner under a given set of conditions. For example, several race studies have found that the percentage of non-heel striking runners increased among faster runners,^{1,2,4,5} suggesting a speed effect. Running surface has also been shown to influence foot strike. Nigg⁶ reports data from an unpublished thesis⁷ showing that barefoot runners are more likely to forefoot strike on asphalt (76.7% forefoot, 23.3% rearfoot), and rearfoot strike on grass (45.7% forefoot, 54.3% rearfoot). Gruber et al.⁸ found that only 20% of habitually shod runners adopted a midfoot or forefoot strike when running barefoot on a soft surface, versus

E-mail address: peter.larson@performancehealthnh.com

Peer review under responsibility of Shanghai University of Sport.



Production and hosting by Elsevier

Table 1
Summary of foot strike patterns reported in observational studies of runners in races. To simplify comparisons, data for asymmetrical runners reported by Larson et al.³ and Kasmer et al.⁴ are not included here.

Study	Description of sample	<i>n</i>	Foot strike type (%)		
			Rearfoot	Midfoot	Forefoot
Kerr et al. ²	9 km mark of 10 km race	628	81.0	19.0	0.0
Kerr et al. ²	20 km mark of marathon	125	79.0	21.0	0.0
Kerr et al. ²	35 km mark of marathon	84	82.0	18.0	0.0
Hasegawa et al. ¹	15 km mark of elite half marathon	283	74.9	23.7	1.4
Larson et al. ³	10 km mark of relay, half, full marathon	881	94.5	3.6	1.9
Larson et al. ³	Marathoners only at 10 km into race	264	95.1	3.4	1.5
Larson et al. ³	Marathoners only at 32 km into race	276	96.4	3.6	0.0
Hayes and Caplan ⁵	Women's 800 m track	34	32.0	41.0	27.0
Hayes and Caplan ⁵	Women's 1500 m track	24	33.0	42.0	25.0
Hayes and Caplan ⁵	Men's 800 m track	71	15.0	50.0	35.0
Hayes and Caplan ⁵	Men's 1500 m track	52	26.0	37.0	37.0
Kasmer et al. ⁴	8.1 km mark of marathon	1151	93.2	6.2	0.6
Larson, this study	Barefoot, 350 m into a 2-mile run on asphalt	169	20.7	20.1	59.2
Larson, this study	Vibram Fivefingers [®] , 350 m into a 2-mile run on asphalt	42	47.6	19.1	33.3

65% adopting a midfoot or forefoot strike when running barefoot on a hard surface.

Of all potential factors contributing to variation in foot strike type, the role of footwear has perhaps been the subject of most debate and research in recent years. This is in part due to increased interest in barefoot running, as well as marketing of “barefoot-style” minimally-cushioned shoes by running footwear companies.

Results of studies that have examined the effects of footwear on foot strike include:

- Lieberman et al.⁹ found that habitually unshod Kenyan and American runners typically land on their midfoot or forefoot while running barefoot, whereas habitually shod Kenyan and American runners tend to contact the ground with the rearfoot/heel first in both shod and unshod conditions.
- Hatala et al.¹⁰ reported that habitually barefoot individuals from the Daasanach tribe of Kenya, a group without a strong running tradition, overwhelmingly tended to land on the rearfoot at a slow jogging pace (2.01–3.00 m/s; 83% rearfoot strikes). Percentage of midfoot strikes increased with running speed among the Daasanach (60% of all foot strikes were classified as midfoot at 6.01–7.00 m/s).
- Squadrone and Gallozzi¹¹ found that strike index was similar among habitually barefoot runners when running unshod or in minimally cushioned shoes (MCS; Vibram Fivefingers, Vibram USA, Concord, MA, USA) as compared to when they ran in conventional cushioned shoes.
- Hamill et al.¹² found that habitually shod subjects typically switched to a midfoot strike when running barefoot, but landed initially on the heel in all shod conditions (including a minimally cushioned shoe).
- Tenbroek et al.¹³ found that habitually shod runners exhibited a flatter foot strike when running barefoot or in

minimally cushioned footwear compared to moderate or thickly cushioned shoes, but all contacted first on the heel.

- Bonacci et al.¹⁴ found that habitually shod runners exhibited a less dorsiflexed ankle at contact when running barefoot compared to when they ran in three shod conditions (conventional shoe, racing flat, and moderately cushioned shoe).
- Lieberman¹⁵ found that Tarahumara runners from Mexico who habitually wear minimally cushioned huarache sandals tend to midfoot or forefoot strike when they run, whereas conventionally shod Tarahumara typically land on the rearfoot.
- Pontzer et al.¹⁶ found that the presence of footwear (minimally cushioned sandals vs. barefoot) had no effect on strike type among Hadza hunter-gatherers.
- Several additional studies have demonstrated that even if habitually shod runners continue to rearfoot strike when barefoot, they tend to land with reduced dorsiflexion of the ankle at contact than when shod.^{17–19}

A limitation of existing studies of foot strike in barefoot and minimally shod runners is that most have been conducted on small sample sizes of subjects in a laboratory setting or along a short outdoor runway. None have examined foot strike patterns of barefoot/minimally shod runners in a race setting on a hard, asphalt surface.

The goals of this study are thus (1) to determine the frequency of forefoot, midfoot, and rearfoot striking in a comparatively large sample of barefoot and minimally shod runners in a recreational road race; (2) to compare foot strike distributions between barefoot and minimally shod runners; and (3) to compare foot strike distributions observed here to those reported in previous studies of recreational distance runners. The null hypotheses tested are: (1) foot strike patterns do not differ between barefoot and minimally shod runners in a recreational road race; (2) foot strike patterns examined here

Download English Version:

<https://daneshyari.com/en/article/1084141>

Download Persian Version:

<https://daneshyari.com/article/1084141>

[Daneshyari.com](https://daneshyari.com)