

# ACCURACY OF SELF-REPORTED FOOTSTRIKE PATTERNS AND LOADING RATES ASSOCIATED WITH TRADITIONAL AND MINIMALIST RUNNING SHOES

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## INTRODUCTION

Since the advent of the modern running shoe in the 1970's, approximately 75-80% of runners have adopted a rearfoot strike pattern.<sup>1,2</sup> Using this strike pattern increases horizontal braking forces and vertical loading rates.<sup>3</sup> Some experts in the industry have recommended a departure from traditional running shoes with cushioned heels in favor of adopting "minimalist" running shoes. The assertion is that wearing minimalist shoes simulates barefoot running and will force runners to adopt a more anterior footstrike pattern than traditional shoes, thus reducing loading rates and internal knee moments in an effort to reduce injuries.

The purposes of this study were to evaluate the accuracy of self-reported footstrike patterns in traditional shoe wearers (TS) and minimalist shoe wearers (MS) and to report the average vertical loading rates among these runners.

## METHODS

Fifty-seven male and female runners (22 TS- and 35 MS) who reported wearing the same type of footwear for at least 6 months during running were asked to report their footstrike tendencies on flat, level surfaces. Runners were then evaluated in the final minute of a five minute run at a self-selected speed on a Bertec instrumented treadmill. Center of pressure data and slow motion videos from a Sony Handycam were used to classify footstrike pattern dichotomously: either rearfoot or anterior (non-rearfoot).

Chi-squared analysis was used to compare self-reported to actual footstrike pattern. A one-way analysis of variance (ANOVA) was used to compare average vertical loading rates (determined

from 20-80% of impact peak or 3-12% stance phase in the absence of an impact peak) and peak vertical ground reaction forces among the following groups: TS with rearfoot strike pattern (TSR), MS with anterior foot strike pattern (MSA), and MS with rearfoot strike pattern (MSR). Post-hoc testing was conducted using Tukey's HSD.

## RESULTS

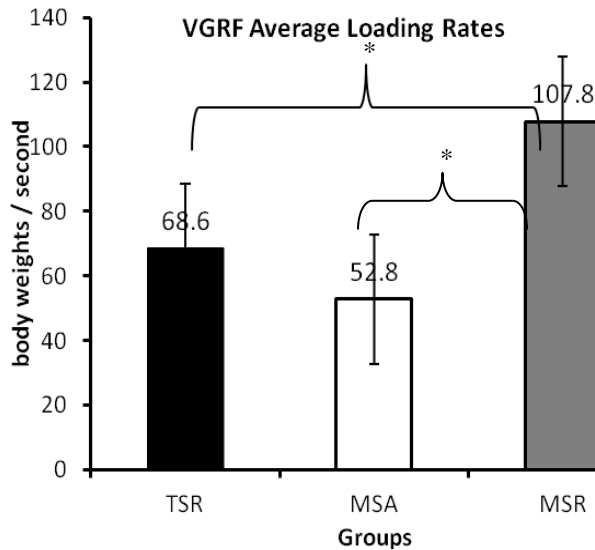
Prior to running, 20 of the 22 (90.9%) TS runners reported utilizing a rearfoot strike pattern. All 22 TS runners, however, exhibited a rearfoot striking pattern. Prior to running, all 35 MS runners reported utilizing an anterior footstrike pattern. Out of the 35 MS runners, 23 demonstrated an anterior footstrike pattern and 12 demonstrated a rearfoot strike pattern. Accuracy of self-reported footstrike pattern in MS runners was 23/35 (65.7%) and overall accuracy of self-reported footstrike pattern was 43/57 (75.4%).

Actual footstrike differed statistically from self-reported footstrike ( $X^2 = 6.90$ , 1df,  $p = .01$ ,  $n = 57$ ). (Table) Loading rates differed among groups ( $F = 15.24$ ,  $p < 0.001$ ). Average vertical loading rates differed among groups (Figure 1,  $F = 15.26$ ,  $p < 0.001$ , TSR-MSR  $p < .001$ , TSR-MSA  $p = 0.18$ , MSA-MSR  $p < 0.001$ ). Peak vertical ground reaction force did not differ among groups (Figure 2,  $F = 0.74$ ,  $p = 0.48$ ).

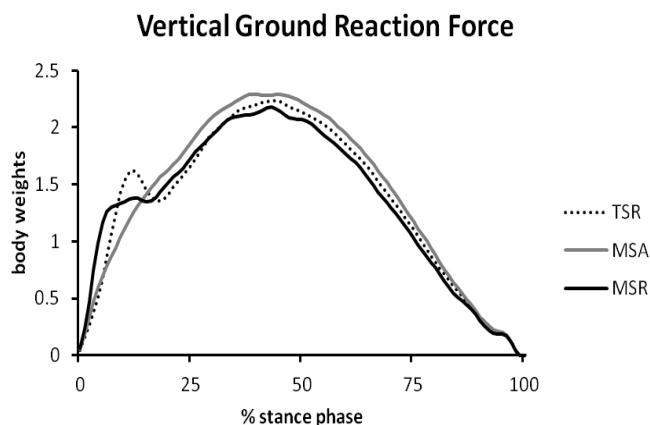
**Table:** Self-reported vs. actual footstrike pattern.

Footstrike pattern	Reported	Actual
Rear footstrike	20	34
Anterior footstrike	37	23

$X^2 = 6.90$ , 1df,  $p = .01$ ,  $n = 57$



**Figure 1:** Average vertical loading rates for rearfoot striking runners in traditional shoes (TSR), anterior footstriking runners in minimalist shoes (MSA), and rearfoot striking runners in minimalist shoes (MSR).



**Figure 2:** Vertical ground reaction force curves for rearfoot striking runners in traditional shoes (TSR), anterior footstriking runners in minimalist shoes (MSA), and rearfoot striking runners in minimalist shoes (MSR).

## DISCUSSION

McCarthy et al. observed 50% of females still demonstrating a rearfoot strike pattern two weeks after transitioning to minimalist footwear.<sup>4</sup> Despite at least six months of accommodation and  $24.6 \pm 25.7$  months in minimalist running shoes,

approximately 1/3 of the MS runners in our sample demonstrated a rearfoot strike pattern and potentially injurious ground reaction force loading rates.

Greater loading rates have been associated with stress fractures<sup>5</sup>, patellofemoral pain syndrome<sup>6</sup>, and plantar fasciitis.<sup>7</sup> Clinicians and runners should understand that running in minimalist shoes with a rearfoot strike pattern may increase the risk of incurring lower extremity musculoskeletal injury.

## CONCLUSIONS

Approximately 1/3 of experienced MS runners in this sample misclassified their footstrike pattern, and demonstrated a rearfoot strike pattern with potentially injurious loading rates.

## REFERENCES

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