



## INFORMATION PAPER

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SUBJECT: Minimalist Running Shoes

1. Purpose. To provide information on minimalist running shoes, ongoing studies, and recommendations for their use in the U.S. Army.

2. Facts.

a. Minimalist running shoes (MRS) are lightweight, low to the ground, and flexible. They provide very little cushioning for the heel and forefoot. Additionally, compared to traditional running shoes, there is minimal slope from the heel to the forefoot in the MRS. This reduction in cushioning and decreased heel-to-toe drop forces the runner to land with a more anterior foot strike when running. Researchers have shown that running in a midfoot or forefoot strike results in decreased impact force for the runner (Cavanagh 1980; Lieberman, et al. 2010; Altman, et al. 2010). By landing on the midfoot or forefoot, the runner is able to absorb and dissipate the landing force within the foot arch and leg musculature. By comparison, the rear foot strike pattern from traditional running shoes, with their technology based cushioned insoles, leads to larger impact magnitudes and rates which are correlated to tibial shock (Davis 2010).

b. There are multiple types of MRS available on the market. All share the same basic structure and function under the same principle of encouraging forefoot or midfoot running. Examples of the MRS available include the Vibram FiveFingers, Merrell Glove, Newton Distance Performance Trainer, Altra Instinct, Keen A86, Inov-8 F-Lite, Terra Plana Evo, and Saucony Hattori.

c. The current U.S. Army policy is that minimalist shoes that do not encompass all of the toes cannot be worn with the Physical Fitness Uniform. There is no current policy limitation on other MRS.

3. Current Research.

a. In a 1982 study, researchers found that the energy cost of walking and running increases disproportionately when the weight of the shoe increases. This study did not compare MRS to traditional running shoes.

b. In a 2005 study, researchers compared slipper conditions and running shoe conditions of 150g and 350g weights. They found a net running efficiency in the slipper groups with the lighter slippers having the greatest efficiency.

c. In an unpublished retrospective study of Harvard Cross Country runners, researchers suggested that there was a 50% reduction in running related injuries in runners who used mid/forefoot running. These runners were also able to increase their training days and had improved performance as measured by running times.

d. In a 2011 study, researchers found that a more anterior foot strike results in an increased stride frequency. When stride frequency increases more than 10%, V<sub>O</sub>2 and rating of perceived exertion also increases.



e. There is ongoing research to compare ground reaction forces in multiple running groups including those using traditional running shoes and those using minimalist shoes as well as those using POSE and Chi running techniques. The expected completion date for this study is 2012.

f. Other researchers have submitted a proposal to prospectively examine biomechanics and injuries in a group of runners training for a half-marathon using different running styles to include minimalist running shoes. The expected completion date for this study is 2014.

g. There are few completed and published studies that examine injuries and performance by comparing traditional running shoe wear to MRS. Therefore, most claims of increased performance or reduced injuries with MRS are based on expectations due to the biomechanical effects of the MRS.

h. What we do know:

- i. Using MRS results in changes to running biomechanics which can reduce the initial impact ground reaction forces for the runner. Propulsive peaks appear larger in barefoot and minimalist runners (Davis, 2010; Divert, 2005).
- ii. Musculoskeletal injuries such as tibial stress fractures and plantar fasciitis are correlated to higher impact loading rates and magnitude (Milner, et al 2006; Pohl, et al 2008).
- iii. Using MRS requires a transition period to avoid the potential of overuse injuries.
- iv. Using MRS can improve intrinsic foot and leg muscle strength (Bruggemann, et al 2005; Robbins and Hanna 1987)
- v. Due to the decreased cushioning in MRS, care should be taken when running on uneven surfaces that have rocks and imperfections.

4. Recommendations. The Office of the Surgeon General is partnering with the US Army Research Institute of Environmental Medicine (USAREIM), the US Army Public Health Command (PHC) and military experts in the field to determine the way ahead. More research is needed on injury surveillance and performance in a population of Soldiers using MRS. Many questions remain unanswered. What we do know at this time is that changing from traditional running shoes to MRS requires a slow and deliberate training period. Foot and leg musculature strength is essential. A proper MRS break-in transition will help to avoid the potential complications of overuse musculoskeletal injuries.