



UPDATE

Barefoot and minimalist running: The current understanding of the evidence



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Abstract Barefoot running and minimalist running have gained considerable popularity in the last years in the running community. This popularity has been achieved by bookseller Born to Run, some specific scientific publications, main stream media coverage and websites devoted to the benefits of barefoot running. However, in the last years, much more evidence has been produced in this topic. This article summarizes the current evidence available on barefoot versus shod running at three different aspects of running: economy running, biomechanical differences and injury rates between both trends. The available current evidence about barefoot or minimalist running versus shod running suggests that there are no systematic benefits of one over the other in any of three different aspects reviewed. Clearly, it seems that the theoretical benefits attributed to barefoot and minimalist running are not supported by the current evidence available.

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PALABRAS CLAVE

Correr descalzo;
Carrera minimalista;
Zapatilla de carrera;
Economía de carrera;
Biomecánica de la
carrera;
Tasas de lesiones;
Impacto de carga

Carrera descalza y minimalista, una comprensión actual de la evidencia

Resumen Correr descalzo y la carrera minimalista son tendencias que han ganado una popularidad considerable entre las comunidades de corredores durante los últimos años. Esta popularidad se ha logrado por el libro superventas *Born to run*, algunas publicaciones científicas, la cobertura de los medios de comunicación generalistas y sitios web devotos de los beneficios de correr descalzo. Sin embargo, en los últimos años se ha producido una gran cantidad de evidencia científica sobre este tema. Este artículo resume la evidencia actual de correr descalzo frente a hacerlo con zapatillas deportivas en 3 aspectos diferenciados: economía de carrera, diferencias biomecánicas y tasas de lesiones entre ambas tendencias. La evidencia científica actual muestra que no hay unos beneficios sistemáticos de una tendencia sobre la

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otra en ninguno de los aspectos antes citados. Claramente, parece que los teóricos beneficios atribuidos a correr descalzo o a la carrera minimalista no están avalados por la evidencia científica más actual.

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Barefoot running and running in minimalist non supporting shoes started to gain considerable popularity in the running communities following the publication of the best-selling book, *Born to Run*, by Chris McDougal¹ in 2010 and a publication by Lieberman et al.² that made the cover of *Nature*, also in 2010. This gave an impetus to a movement that was always lingering in small numbers to grow exponentially over the next few years. This led to much coverage in the running and main stream media about the benefits of barefoot or minimalist running, along with many lay books and websites devoted to the cause. There also emerged many evangelists who promoted barefoot running and the denouncing of the need for supportive or cushioned running shoes.

At that initial stages of the movement there was little or no research that showed any benefit in terms of injury with the use of the technical features that were being built into running shoes that were claimed to prevent and help running injuries.³ This was widely touted as being evidence for not using shoes. Substantial claims were made in social media about the evidence that supported barefoot or minimalist running, a lot of it based on the work of Lieberman et al.² and extrapolation from other research. Equally there were claims made in social media that this is not what the research was showing. With such opposing views and the availability of social media, the debates at conferences and online were often widely covered. A lot of the debate was largely driven by the use of anecdotes and testimonials from those on both sides of the debates.

A major underpinning of the evidence for barefoot running claims was based on the work of Lieberman et al.² This study compared impacts loading parameters between heel striking shod runners and forefoot or midfoot striking barefoot runners and found that the heel strike transient was higher. This was then extrapolated as showing that heel striking was less than desirable and midfoot or forefoot striking was better. This was based on the premise that impact loading parameters are related to overuse injuries in runners. Even the opening sentence in the paper by Lieberman et al.² claimed that "Running can be most injurious at the moment the foot collides with the ground", when they provided no citation to support that claim and the evidence that this is the case is far from compelling. The most recent systematic review of the topic⁴ finds that there is very little evidence linking overuse injury in runners to impact loading parameters, with the exception of tibial stress fractures, which is not a very common running injury. As barefoot or minimalist runners tend to forefoot or midfoot strike, this study by Lieberman et al. has been widely used to support and promote the concept of barefoot running, when in reality that is not what it showed.

While there has been other research that was claimed to support barefoot or minimalist running at that time, most of that came down to how research is interpreted and spun like the example above of how the Lieberman et al. study was used. This did not stop manufacturers of the minimalist or nearly-barefoot footwear from making claims about the evidence to support their product. The unsupported nature of the claims led to one class-action law suit against one manufacturer for their claims that there was "ample evidence" to support barefoot running, when in reality there was not. They settled the case to avoid a trial and withdrew from making the claims.

Since that time there have now been many studies done comparing barefoot and shod running. Some of these studies looked at running economy, some looked at biomechanical differences and some looked at injury rates. This has resulted in several systematic reviews comparing the two.⁵⁻¹⁰ All reviews reached the same conclusion that there were no systematic benefits of barefoot or minimalist running over shod running. This meant that those doing the academic publishing with formal systematic reviews of the literature were reaching different conclusions on the research that those who were evangelizing barefoot running in social media.

When it comes to the running economy and barefoot running, the assumption is that if you do away with the weight of the running shoe, then the running should be more economical. However, that is not what the preponderance of evidence is supporting. The most recent systematic review of the running economy studies¹¹ reported that running shoes that had greater shoe cushioning, greater longitudinal shoe stiffness and greater comfort were associated with improvements in running economy, suggesting that barefoot was not more economical. They also concluded that running in lighter shoes or barefoot was more economical than heavy shoes. There was also no difference between light shoes and barefoot. Given the developments in running shoe materials is now advanced to the stage that the materials used in running shoes are very light, just how much more economical they are is open to debate. Also of note, is that all the studies on running economy are lab based using lab based parameters. There have been no studies on runners using different weights of footwear in the actual field.

The lab based biomechanical studies have reported a number of differences between barefoot and shod running, but almost all of these are just differences and those differences are not linked to being better or linked to any systematic increased or decreased risk for injury. For example, McCarthy et al.¹² showed that knee loads were lower in barefoot running, but the ankle loads were higher. While Lieberman et al.² showed that heel impacts were reduced in barefoot running, Olin and Gutierrez¹³ showed that tibial

loads were higher in the barefoot group. The interpretation of these types of studies comparing barefoot to shod running is that the loads are higher in some places and lower in others. This means that there are no systematic benefits of one over the other, it means that the loads are just moved to a different place if you move from one to the other. This may have individual, subject specific benefits, but those benefits are not systematic to everyone. The increased loads in a different set of tissue may or may not increase the risk for injury in some individuals and may or may not in another set of individuals.

The final group of studies, and probably the most important are the actual field based studies on actual injury rates between shod and barefoot or minimalist running. Two studies have looked at this. Geir et al.¹⁴ looked retrospectively at a military population of 1332 soldiers who generally wear running shoes during their basic training. Of that cohort they looked at 17% wore what could be considered minimalist shoes. They reported no differences in the injury rates between the groups. In the prospective study by Altman and Davis¹⁵ which followed 107 barefoot and 94 shod found that the injury rate was lower in the barefoot group, but the barefoot group covered less distances than the shod group. After adjusting for distance, the injury rate between the two groups was the same.

The preponderance of the current evidence on barefoot or minimalist running vs. shod is that there are no systematic benefits of one over the other. This is in direct contrast to the claims that were made about the evidence at the inception of the most recent barefoot running trend. However as the biomechanical studies show that the loads are just moved to different sets of tissues when barefoot vs. shod running this has individual or subject specific implications which would account for anecdotes and testimonials from those who promote barefoot running. Up to a third of runners have tried or experimented with running barefoot or in minimalist running shoes with not many staying with it. The most recent sales figures put the sales of minimalist running shoes at around 2–3% of the specialty running shoe market (Leisure Trends; personal communication, 2016), indicating that runners have lost interest in the trend.

There is nothing wrong with barefoot running, provided that the tissues that have an increased load in them are given time to adapt to the loads and in some people that increase in loads may be too great. This also means that it has potential to help some runners by reducing the load in

a problematic tissue. What is wrong with barefoot running is the claims that get made for it by those that promote it are not supported by the current understanding of the preponderance of the evidence.

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