

Analysis of the benefits of barefoot running



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To what extent does barefoot running limit the amount of running injuries as well as assist in rehabilitation?

For thousands of years, running barefoot has been the natural way to run for humans. As time went on and technological advancements arose, shoes have taken over in developed countries whereas many developing countries continue to follow minimalist running. These two different groups of barefoot and shoe-bearing runners have scientifically proven that barefoot running both limits the amount of running injuries and helps prevent them. Due to the strengthening abilities, naturality, and limitation of impact when running, barefoot running (minimalist running) has been proven to limit the number of running injuries as well as assist in rehabilitation of contracted injuries.

Barefoot running is the natural way to run since humans' primordial ancestors ran without shoes. Scientists have discovered footprints and have seen that runners from thousands of years ago were clearly barefoot. Barefoot running in these ancestors proves to be effective and efficient. These ancestors were able to run unaided and did not get injured nearly as much we humans do today. The reason we know this is because many areas of the world do not have access to shoes and are very rarely injured. Specifically, Kenyans and Ethiopians are the best example of these types of minimalist runners. A 2012 study by Hatala et al. focusing on 38 runners of the Daasanach tribe in Kenya found that a majority of runners favored barefoot instead of a shoes. These barefoot runners have proven to scientists and biomechanists that running without shoes limits the amount of contractable injuries. When these runners did receive shoes, their injury levels skyrocketed.

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Minimalist Running Shoes Improve Running Economy By 3.32% was a study designed to examine if running economy differs in minimal shoes versus standard running shoes, and in forefoot versus rear foot strike gaits. The subjects in this study were 52 collegiate cross country runners. The cost of O₂ transport, our VO₂ max, how efficiently people will run when they're at those speeds. And what the researchers had the subjects do is run on the treadmill at three meters a second and to get rid of some variables. It could be argued that shoe mass and stride frequency were controlled, so they would not play a factor in that. Stride affect the runners because stride decreases as cadence increases. The researchers found that runners were 2.41% more economical in the minimal shoe condition when forefoot striking. 3.32% more economical in the non shoe condition when rear foot striking compared to the traditional running shoe group. Then they concluded that running in a minimal running shoe was more economical than a traditional running shoe. They thought this was due to because of the buildup of elastic energy, and then the release of it. The release of this energy allows for the runners to increase their speed. These runners were then able to increase their overall economy.

Running barefoot incorporates a natural rhythm and form when actually running. Barefoot running encourages a low-impact gait. The lower the heel-to-toe drop, the more the shoe naturally encourages you to land on your midfoot or forefoot rather than your heel. Though no study has definitively proven that heel striking causes runners any more injuries than forefoot or midfoot striking, it is generally considered a higher-impact stride. Minimalist running won't automatically alter your gait. But they can be a good teaching

tool if you want to learn how to run with a midfoot or forefoot strike. Their lack of cushioning encourages something called “ proprioception.”

Proprioception is the ability to feel your own connection to the terrain beneath your feet. Minimalist shoes are ideal for runners who value feeling highly nimble and in touch with the ground. Running barefoot causes the feet to not strike the ground as hard. Due to the lack of shoes (extra weight), the feet systematically force themselves to not strike the ground as hard since there is no cushioning. Not striking the ground as hard causes the feet and legs to not become injured. Researchers point out that athletes should be careful when beginning the practice of barefoot running. They recommend conducting a multidisciplinary study of the biomechanics of the musculoskeletal system. Both the static (podiatric and postural) as well as dynamic (ambulatory and running locomotion) levels are in the musculoskeletal system.

Minimalist running improves overall running economy. This study evaluated the effects of four weeks familiarization to simulated barefoot running on running economy compared to a traditional running shoes. Researchers had these runners complete two running economy test 24 hours apart, in both the barefoot condition and then in traditional running shoes at 11 kilometers an hour and 13 kilometers an hour. After two weeks, the overall running economy or efficiency improved by 3% whereas the shoe group's economy did not change. Runners in shoes report greater rates of injuries. This study examined the effects of progressive increases in footwear minimalism on injury, incidence, and pain perception in recreational runners. Two groups of runners received either a pair of running shoes or were asked to run barefoot

on a 3 mile loop. The group with the running shoes had higher reports of injury whereas the barefoot group did not. Kenyan marathoners report the highest level of running economy in the world due to their upbringing.

Distance runners in Kenya (as well as Ethiopia and Eritrea) have the highest levels of running economy because they ran barefoot as children. Many of these runners were forced to run up to 10 kilometers (6 miles) to school barefoot. Authors in the journal *Physical Therapy in Sport* followed 26 rear foot strike shod runners as they performed an 8-10 week transition to barefoot running (Hashish 2016). The runners were evaluated in a biomechanics laboratory both before and after the training period. The authors found 18 of 26 runners successfully switched to a barefoot running program. 8 switched to a mid foot strike, 3 switched to a forefoot strike, and 7 surprisingly kept their rear foot strike pattern despite being barefoot.

Barefoot running increases flexibility in the foot and its tendons. There is some evidence that less flexible shoe may improve running economy. However, there appears to be a “ Goldilocks effect” where a little bit of additional flexibility improves running economy, but too much will actually have the opposite effect. Frederickson (2007) says, “ It also appears that the amount of stiffness that is ‘ just right’ varies considerably from runner to runner, though this may be related to the runner’s weight with heavier runners benefiting more.” (pg. 8) The stiffer shoes were not because of thicker foam or more rubber outsole. These carbon fiber plates are likely to be far more springy than typical inflexible running shoes. These are the normal causes of inflexibility, but the addition of carbon fiber plates to highly flexible shoes. Shoes with thicker soles led to more injuries. This is because

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there is more cushion for the sole. The more cushioning in the sole, the higher the increase in injuries. According to Hart (2008), " Minimalist shoes may work better than thick running shoes. Shoes like moccasins or sandals may work better than thick shoes, however barefoot running is still the best way to run." (pg. 6)

Minimalist running decreases the force exerted on the ground when stepping which in turn lessens the impact on the legs. Vertical Oscillation is less efficient without running shoes.

Vertical oscillation occurs more frequently when wearing running shoes since it causes runners to jump higher vertically rather than propel themselves forward. Morris (2007) said, " Vertical oscillation strains the tendons by having them propel the body upward rather than forward." (pg. 31) A high Vertical Oscillation interrupts proper form additionally. In 16 national level runners, greater Vertical Oscillation was associated with improved Running Economy, the opposite of what would be expected. The study found that Vertical Oscillation accounted for 7% of the variation due to biomechanical differences.

A 1997 study found elite runners have less Vertical Oscillation than sub-elite runners due to their use of minimalist running. Diehl (2009) stated, " Running with exaggerated Vertical Oscillation reduces Running Economy." It's possible to use excessive bounce to intentionally compromise running, and might indicate that some runners could have a problematic level of Vertical Oscillation. A study of 31 runners found that there was a non-significant relationship between increased Vertical Oscillation and reduced

Running Economy. The most economic runners having a Vertical Oscillation of 9.1cm and the least economic having 9.6cm. Although vertical oscillation may impact the feet and legs, shoes still are the root cause. Thick soles naturally make the runner go up rather than just straight. Barefoot running reduces vertical oscillation. Running to exhaustion may increase Vertical Oscillation due to wearing shoes. Vertical Oscillation tends to decrease with increased cadence. Cadence is increased the highest in minimalist running conditions. Not wearing shoes decreases vertical oscillation which in turn, decreases the impact exerted on joints. A higher cadence means that each stride is shorter, so less time is spent in the air. The less time spent in the air, the less vertical oscillation. The less vertical oscillation, the less impact there is on the legs. Feedback to reduce Vertical Oscillation resulted in impaired Running Economy. The study used real-time feedback to encourage runners to reduce their Vertical Oscillation, but the study lasted a relatively short time. It's possible that the impaired Running Economy was a result of the initial change in biomechanics. A lower vertical oscillation means a higher and better running economy. The better the running economy, the less the injuries may arise. The fewer the injuries, the more the runner may improve.

Barefoot running is the natural way to run since humans' primordial ancestors ran without shoes. In conclusion, due to the naturality of running barefoot for humans, it has been clearly proven to be beneficial towards fighting and not contracting injuries. According to Morris (2007), "Minimalist Running naturally strengthens the legs, which in turn reduces the amount of impact and breaking." In conclusion, barefoot running strengthens the legs

and feet which in turn reduced the number of injuries that runners face. Nigg (2015) stated, “ Barefoot running alters the biomechanics of a runner for the better. In conclusion, running without shoes alters the biomechanics of runners and improves the overall form and quality of the running which in turn reduces the chances of injury.” (pg. 23)

Unfortunately with all the research being done on the effects of barefoot running, at the moment we have more questions than we do answers. The other big issue that needs to be taken into consideration is the runner’s biomechanics/foot posture. Some runners will never be able to run on their heels due to functional restrictions. In contrast some runners will not be able to run on the balls of their feet due to their foot biomechanics. Yet, biomechanists and scientists can agree that barefoot running is the proper way to run and assist in rehabilitation.

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