



Barefoot Training – An Insight

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Editorial

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- A commitment to walking and running on two legs distinguishes humans from apes and has long been the defining adaptation of the hominins, the lineages that include both humans and our extinct relatives. This form of locomotion termed bipedalism has been around for millions of years and we have been unshod for more than 99% of that time.

Worldwide data published in <https://runrepeat.com/research-marathon-performance-across-nations>, by Jens Jakob Andersen a competitive runner and statistician from Copenhagen Business School shows data of changes in growth in popularity of marathon running across the globe from 1986 to 2018. Worldwide growth has increased to +49.43% since 2008 and participation increase in India is +229.86%.

Running has been looked upon has a favorite activity presently due to the advantages it offers which is not limited to:

- Increased focus on healthy lifestyle
- Convenient
- Flexible
- Affordable
- Minimum equipment
- Individual or group participation
- Health benefits
- Prevention of high BP
- Weight loss
- Increased bone density
- Lessened effects of asthma
- Strengthen immune system
- Boost physical strength
- Strengthen joints and improve stability
- Reduced effects of diabetes

- Mental health

As with many sports the reality with running is that there are chances of nagging issues, mild to severe, related to running injuries. The average injury rates are 19.4% to 92.4% overall, related to the human body and 19.4% to 79.3% of lower extremity. Up to 70% of recreational and competitive runners sustain overuse injuries during any 12-month period.

Knee injuries account to 42% followed by foot and ankle 17%. The common injuries are Plantar Fasciitis, Achilles Tendinopathy, Medial Tibial Stress Syndrome, Patellofemoral Pain Syndrome Ilio Tibial Band Syndrome and Hamstrings strain and most of the injuries are overuse than acute.

The established risk factors contributing to injury in runners can be intrinsic or extrinsic. Intrinsic risk factors are anatomical, physiological and mechanical related whereas extrinsic factors are related to training, appropriate recovery periods, adequate hydration and nutrition, training terrains and type of footwear.

In the past 30 years running has changed from something done by trained runners to an activity enjoyed by the masses. With an increase in participation of marathon runners all around the world, there is a need to identify the role various sports shoes used predominantly by runners on whether they really are to prevention of injuries and improve performance faster.

It is also imperative to understand the role of barefoot running which is gaining higher levels of significance presently around the globe. This has led to the popular notion that barefoot training or running is much better than using any type of shoes.

Understanding these differences between shod and barefoot running requires a basic explanation on biomechanics of these running patterns.

Greg Lehman's barefoot, forefoot strike and heel strike – A Biomechanics summary provides an insight into the comparison of biomechanics of both shod and bare foot conditions. He summarizes the kinematic changes that occur whenever a runner goes to barefoot from shod foot which is as follows:

- A trend to shift from rear foot striking to landing more on the mid foot or forefoot
- An increase in step frequency
- A decrease in step length
- The foot is more planter flexed (i.e., the toes point down at contact) and there is a greater degree of ankle motion
- A decrease in the amount of peak pronation or calcaneal eversion, which is most evident in runners who pronate a great deal. Going barefoot decreases peak eversion from 10.3 degrees to 6.7 degrees in moderate pronators and from 14.8 degrees to 9.2 degrees in super pronators.
- The time it takes to get to maximal calcaneal eversion decreases in barefoot.
- Total eversion is increases with barefoot running. Even though there is less pronation, the foot starts in a greater degree of inversion when barefoot. Therefore, the heel travels a greater distance when striking the ground to reach maximal eversion/pronation.

He also adds that there is a decrease or complete reduction in the impact peak when the foot strikes the ground but the push off peak is unchanged. The initial impact transient is not always eliminated with barefoot running. While, other researchers show that the initial impact peak or impact transient is completely washed out rather than just decreased, this is not always seen.

According to the work of Laughton, et al. [1] forefoot strikers have greater leg stiffness in general but less ankle stiffness. They have less ankle stiffness because there is more time and range of motion for the ankle to bend. Essentially, there is more time for the ankle to spread out the joint torque during impact because the ankle moves through a larger range with the forefoot strike (remember, the foot contacts the ground with the toes down in Plantar Flexion). These authors also found that the knee doesn't flex as much in the forefoot strike condition as in the rearfoot strike conditions (30 degrees vs about 34 degrees), therefore there is greater overall leg stiffness.

Conversely, according to the work of Lieberman, et al. [2] forefoot strikers have greater leg compliance (defined as the drop in the body's centre of mass relative to the vertical force

during the period of impact) [3] meaning there's also greater knee flexion as well as ankle flexion when striking with the fore foot.

As quoted rightly by Jay Dicharry, [4] a Physiotherapist and Expert Biomechanical analyst, "The shoe industry as a whole does a really horrible job of matching footwear to feet". There is a huge gap in understanding of whether individuals could wear standard running shoes yet still be trained to run in a manner that mimics all kinematics of barefoot, forefoot strike running. Research is also lacking in the full body kinetic analysis comparing all the different foot conditions of running as foot types also influence injury incidence and prevalence.

There is scanty literature related to long term studies investigating changing stride mechanics on injury prevalence and running efficiency [5]. More studies like these are required to provide data instead of opinion, and testable models and scientific explanation instead of anecdotes. It is also apparent that a carefully designed bio-medical study with an evidence-based approach is badly needed to assess the competing claims as to what if anything is the best cover for a runner's foot [6].

Since literature clearly states that there are biomechanical differences between barefoot and shodfoot running, the injury risk associated with barefoot running also needs to be explored, as it is largely unknown [7-9]. A paradigm shift in the way we think about bio mechanics of running in relation to food strike, the type of footwear used, and even the treatment of foot related to type of footwear used, may be emerging. Studies of better quality and high level of evidence are needed before we decide to shed our shoes and shift to barefoot training.

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