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Gauri Chaitanya Gauri

Manipal College of Health Professions

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Differences in Running Kinetics and Kinematics Across Footwear Conditions - A systematic review.

Running has numerous health benefits, such as reducing the occurrence of obesity, risk of metabolic syndrome, cancer, diabetes and many other chronic diseases(1). Running has been associated with 30 % reduction in all-cause mortality, and a 45% reduction in cardiovascular mortality as compared to non-runners(2). Even though, running is beneficial, prolonged participation can predispose to overuse musculoskeletal and soft tissue injuries(2). Common running injuries include muscle-tendon strains, ligament sprains, tendinopathies, severe knee injuries (patello-femoral pain, chondromalacia patella and meniscal damage), stress fractures, medial tibial stress syndrome (or 'shin splints'), plantar fasciitis (pain at the foot's underside) and iliotibial stress disorder(2). Athletic shoes are believed to be ergogenic and offer protection against certain athletic injuries(3). Shoes enable forefoot bending stiffness at the optimal range, reduced impact forces and loading rates, reduced tibial acceleration, shock attenuation by providing cushioning effect (3)(4). Running shoes are available within a large spectrum – from maximalist to minimalistic ones. Owing to the materials used, their proportions and the design, shoes can influence the mechanics of running independently. Minimalist shoes, characterized by lower heel thickness and heel drop, increase plantar flexion at initial foot contact and promote midfoot or forefoot attack - which is associated with decreased patellofemoral loading and thus reduced risk of selected injuries when compared to conventional or maximalist shoes(5)(6). On the contrary studies have also reported that running in minimalist shoes increases the vertical load on lower extremity at least in the short term by increasing instantaneous loading rate, rate of vertical loading across calf and Achilles tendon, tibial acceleration and peak tibial internal rotation which is associated with overuse tendon and bony injuries(7)(8)(9). On the other end of spectrum, maximal shoes characterized by greater midsole cushioning, has recorded lower instantaneous loading rate and reduced loads across the Achilles tendon when compared with minimalist shoes, likely offering protection from injuries related to vertical loading(7). However, longer duration of eversion during stance and higher degree of eversion at toe-off – which are implicated to higher injury risk – are recorded with wearing maximalist shoes(7). Coordination of movements across lower extremity joints during running has also been implicated to injury risk(10) A recent trial found that maximalist shoes influences rearfoot- knee and rear foot tibia coordination patterns as against minimalist and conventional shoes(11).