



The Science and Rehabilitation of Common Running Injuries

Independent Study
Course 30.1.1

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REFERENCES

1. Yamato TP, Saragiotto BT, Hespanhol LC Jr, Yeung SS, Lopes AD. Descriptors used to define running-related musculoskeletal injury: a systematic review. *J Orthop Sport Phys Ther.* 2015;45(5):366-374. doi:10.2519/jospt.2015.5750.
2. Yamato TP, Saragiotto BT, Lopes AD. A consensus definition of running-related injury in recreational runners: a modified Delphi approach. *J Orthop Sports Phys Ther.* 2015;45(5). doi:10.2519/jospt.2015.5741.
3. Saragiotto BT, Yamato TP, Hespanhol LC Jr, Rainbow MJ, Davis IS, Lopes AD. What are the main risk factors for running-related injuries? *Sport Med.* 2014;44(8). doi:10.1007/s40279-014-0194-6.
4. Van Gent RN, Siem D, Van Middeloop M, Van Os AG, Bierma-Zeinstra SMA, Koes BW. Incidence and determinants of lower extremity running injuries in long

- distance runners: a systematic review. *Br J Sports Med.* 2007;41(8):469-480; discussion 480.
5. Hreljac A. Impact and overuse injuries in runners. *Med Sci Sport Exerc.* 2004;36(5):845-849. doi:10.1249/01.MSS.0000126803.66636.DD.
 6. Messier SP, Martin DF, Mihalko SL, et al. A 2-year prospective cohort study of overuse running injuries: the runners and injury longitudinal study (TRAILS). *Am J Sports Med.* 2018;46(9):2211-2221. doi:10.1177/0363546518773755.
 7. Taunton JE, Ryan MB, Clement DB, McKenzie DC, Lloyd-Smith DR, Zumbo BD. A retrospective case-control analysis of 2002 running injuries. *Br J Sports Med.* 2002;36(2):95-101. doi:10.1136/bjism.36.2.95.
 8. Zadpoor AA, Nikooyan AA. The relationship between lower-extremity stress fractures and the ground reaction force: a systematic review. *Clin Biomech.* 2011;26(1):23-28. doi:10.1016/j.clinbiomech.2010.08.005
 9. Pohl MB, Hamill J, Davis IS. Biomechanical and anatomic factors associated with a history of plantar fasciitis in female runners. *Clin J Sport Med.* 2009;19(5):372-376. doi:10.1097/JSM.0b013e3181b8c270.
 10. Hreljac A, Marshall RN, Hume PA. Evaluation of lower extremity overuse injury potential in runners. *Med Sci Sport Exerc.* 2000;32(9):1635-1641. doi:10.1097/00005768-200009000-00018.
 11. Milner CE, Ferber R, Pollard CD, Hamill J, Davis IS. Biomechanical factors associated with tibial stress fracture in female runners. *Med Sci Sports Exerc.* 2006;38(2):323-328. doi:10.1249/01.mss.0000183477.75808.92.
 12. Napier C. A clinical gait retraining approach to reducing kinetic risk factors of running-related injury. *J Sci Med Sport.* 2018;21(Suppl 1):S4. doi:10.1016/j.jsams.2018.09.014.
 13. Lorimer AV, Hume PA. Achilles tendon injury risk factors associated with running. *Sport Med.* 2014;44(10):1459-1472. doi:10.1007/s40279-014-0209-3.
 14. Butler RJ, Crowell HP, Davis IMC. Lower extremity stiffness: implications for performance and injury. *Clin Biomech.* 2003;18(6):511-517. doi:10.1016/S0268-0033(03)00071-8.
 15. Arampatzis A, Brüggemann GP, Metzler V. The effect of speed on leg stiffness and joint kinetics in human running. *J Biomech.* 1999;32(8):811-820. doi:10.1016/S0021-9290(99)00133-5.
 16. DeVita P, Skelly WA. Effect of landing stiffness on joint kinetics and energetics in the lower extremity. *Med Sci Sports Exerc.* 1992;24(1):108-115.
 17. Dufek JS, Bates BT. The evaluation and prediction of impact forces during landings. *Med Sci Sports Exerc.* 1990;22(3):370-377.
 18. Goodwin JS, Troy Blackburn J, Schwartz TA, Blaise Williams DS. Clinical predictors of dynamic lower extremity stiffness during running. *J Orthop Sports Phys Ther.* 2019;49(2):98-104. doi:10.2519/jospt.2019.7683.
 19. Adams D, Pozzi F, Carroll A, Rombach A, Zeni J. Validity and reliability of a commercial fitness watch for measuring running dynamics. *J Orthop Sports Phys Ther.* 2016;46(6):471-476. doi:10.2519/jospt.2016.6391.
 20. Schubert AG, Kempf J, Heiderscheid BC. Influence of stride frequency and length on running mechanics. *Sports Health.* 2014;6(3):210-217. doi:10.1177/1941738113508544.
 21. Willy RW, Buchenic L, Rogacki K, Ackerman J, Schmidt A, Willson JD. In-field gait retraining and mobile monitoring to address running biomechanics associated with tibial stress fracture. *Scand J Med Sci Sport.* 2016;26(2):197-205. doi:10.1111/sms.12413.
 22. Lenhart RL, Thelen DG, Wille CM, Chumanov ES, Heiderscheid BC. Increasing running step rate reduces patellofemoral joint forces. *Med Sci Sports Exerc.* 2014;46(3):557-564. doi:10.1249/MSS.0b013e3182a78c3a.
 23. Adams D, Pozzi F, Willy RW, Carrol A, Zeni J. Altering cadence or vertical oscillation during running: effects on running related injury factors. *Int J Sports Phys Ther.* 2018;13(4):633-642. doi:10.26603/ijst20180633.
 24. Bertelsen ML, Hulme A, Petersen J, et al. A framework for the etiology of running-related injuries. *Scand J Med Sci Sport.* 2017;27(11):1170-1180. doi:10.1111/sms.12883.
 25. Esculier JF, Bouyer LJ, Dubois B, Frémont P, Moore L, Roy JS. Effects of rehabilitation approaches for runners with patellofemoral pain: protocol of a randomised clinical trial addressing specific underlying mechanisms. *BMC Musculoskelet Disord.* 2016 Jan 6;17:5. doi:10.1186/s12891-015-0859-9.
 26. Dye SF. The pathophysiology of patellofemoral pain: a tissue homeostasis perspective. *Clin Orthop Relat Res.* 2005 July;(436):100-110. doi:10.1097/01.blo.0000172303.74414.7d.
 27. van der Worp MP, ten Haaf DSM, van Cingel R, de Wijer A, Nijhuis-van der Sanden MWG, Staal JB. Injuries in runners: a systematic review on risk factors and sex differences. *PLoS One.* 2015;10(2):e0114937. doi:10.1371/journal.pone.0114937.
 28. Langley B, Cramp M, Morrison SC. Selected static foot assessments do not predict medial longitudinal arch motion during running. *J Foot Ankle Res.* 2015;8(1):1-6. doi:10.1186/s13047-015-0113-6.
 29. Lun V. Relation between running injury and static lower limb alignment in recreational runners. *Br J Sports Med.* 2004;38(5):576-580. doi:10.1136/bjism.2003.005488
 30. Livingston LA. The quadriceps angle: a review of the literature. *J Orthop Sports Phys Ther.* 1998;28(2):105-109. doi:10.2519/jospt.1998.28.2.105.
 31. Rauh MJ, Koepsell TD, Rivara FP, Rice SG, Margherita AJ. Quadriceps angle and risk of injury among high

- school cross-country runners. *J Orthop Sports Phys Ther.* 2007;37(12):725-733. doi:10.2519/jospt.2007.2453.
32. Redmond AC, Crosbie J, Ouvrier RA. Development and validation of a novel rating system for scoring standing foot posture: the Foot Posture Index. *Clin Biomech.* 2006;21(1):89-98. doi:10.1016/j.clinbiomech.2005.08.002.
 33. Pérez-Morcillo A, Gómez-Bernal A, Gil-Guillen VF, et al. Association between the Foot Posture Index and running related injuries: a case-control study. *Clin Biomech.* 2019 Jan;61:217-221. doi:10.1016/j.clinbiomech.2018.12.019.
 34. Buist I, Bredeweg SW, Lemmink KAPM, Van Mechelen W, Diercks RL. Predictors of running-related injuries in novice runners enrolled in a systematic training program: a prospective cohort study. *Am J Sports Med.* 2010;38(2):273-280. doi:10.1177/0363546509347985.
 35. Mucha MD, Caldwell W, Schlueter EL, Walters C, Hassen A. Hip abductor strength and lower extremity running related injury in distance runners: a systematic review. *J Sci Med Sport.* 2017;20(4):349-355. doi:10.1016/j.jsams.2016.09.002.
 36. Barton CJ, Lack S, Malliaras P, Morrissey D. Gluteal muscle activity and patellofemoral pain syndrome: a systematic review. *Br J Sports Med.* 2013;47(4):207-214. doi:10.1136/bjsports-2012-090953.
 37. Christopher SM, McCullough J, Snodgrass SJ, Cook C. Do alterations in muscle strength, flexibility, range of motion, and alignment predict lower extremity injury in runners: a systematic review. *Arch Physiother.* 2019 Feb 12;9:2. doi:10.1186/s40945-019-0054-7.
 38. Finnoff JT, Hall MM, Kyle K, Krause DA, Lai J, Smith J. Hip strength and knee pain in high school runners: a prospective study. *PM R.* 2011;3(9):729-801. doi:10.1016/j.pmrj.2011.04.007.
 39. Yagi S, Muneta T, Sekiya I. Incidence and risk factors for medial tibial stress syndrome and tibial stress fracture in high school runners. *Knee Surg Sports Traumatol Arthrosc.* 2013;21(3):556-563. doi:10.1007/s00167-012-2160-x.
 40. Daoud AI, Geissler GJ, Wang F, Saretsky J, Daoud YA, Lieberman DE. Foot strike and injury rates in endurance runners: a retrospective study. *Med Sci Sports Exerc.* 2012;44(7):1325-1334. doi:10.1249/MSS.0b013e3182465115.
 41. Damsted C, Glad S, Nielsen RO, Sørensen H, Malisoux L. Is there evidence for an association between changes in training load and running-related injuries? a systematic review. *Int J Sports Phys Ther.* 2018;13(6):931-942. doi:10.26603/ijsp.20180931.
 42. Damsted C, Parner ET, Sørensen H, Malisoux L, Hulme A, Nielsen RO. The association between changes in weekly running distance and running-related injury: preparing for a half marathon. *J Orthop Sport Phys Ther.* 2019;49(4):230-238. doi:10.2519/jospt.2019.8541.
 43. Arnold MJ, Moody AL. Common running injuries: evaluation and management. *Am Fam Physician.* 2018;97(8):510-516.
 44. Bolgla LA, Boling MC, Mace KL, DiStefano MJ, Fithian DC, Powers CM. National athletic trainers' association position statement: management of individuals with patellofemoral pain. *J Athl Train.* 2018;53(9):820-836. doi:10.4085/1062-6050-231-15.
 45. Giangarra C, Manske R. *Clinical Orthopaedic Rehabilitation: A Team Approach.* 4th ed. Elsevier; 2018.
 46. Esculier JF, Bouyer LJ, Dubois B, et al. Is combining gait retraining or an exercise programme with education better than education alone in treating runners with patellofemoral pain? a randomised clinical trial. *Br J Sports Med.* 2018;52(10):659-666. doi:10.1136/bjsports-2016-096988. doi:10.1136/bjsports-2016-096988.
 47. Rodriguez-Merchan EC. Evidence based conservative management of patello-femoral syndrome. *Arch Bone Jt Surg.* 2014;2(1):4-6.
 48. Willy RW and Meira EP. Current concepts in biomechanical interventions for patellofemoral pain. *Int J Sports Phys Ther.* 2016;11(6):877-890.
 49. Jensen JL, Marstrand PCD, Nielsen JB. Motor skill training and strength training are associated with different plastic changes in the central nervous system. *J Appl Physiol.* 2005;99(4):1558-1568. doi:10.1152/jappphysiol.01408.2004.
 50. Teng HL, Powers CM. Sagittal plane trunk posture influences patellofemoral joint stress during running. *J Orthop Sports Phys Ther.* 2014;44(10):785-792. doi:10.2519/jospt.2014.5249.
 51. Noehren B, JP S, IS D. The effect of real-time gait retraining on hip kinematics, pain and function in subjects with patellofemoral pain syndrome. *Br J Sport Med.* 2010;45(9):691-696.
 52. Willy R, Scholz J, Davis I. Mirror gait retraining for the treatment of patellofemoral pain in female runners. *Clin Biomech.* 2012;27(10):1045-1051.
 53. Orchard JW, Fricker PA, Abud AT, Mason BR. Biomechanics of iliotibial band friction syndrome in runners. *Am J Sports Med.* 1996;24(3):375-379. doi:10.1177/036354659602400321.
 54. Fredericson M, Cookingham CL, Chaudhari AM, Dowdell BC, Oestreicher N, Sahrman SA. Hip abductor weakness in distance runners with iliotibial band syndrome. *Clin J Sport Med.* 2000;10(3):169-175. doi:10.1097/00042752-200007000-00004.
 55. Niemuth PE, Johnson RJ, Myers MJ, Thieman TJ. Hip muscle weakness and overuse injuries in recreational runners. *Clin J Sport Med.* 2005;15(1):14-21. doi:10.1097/00042752-200501000-00004.
 56. Noehren B, Davis I, Hamill J. ASB clinical biomechanics award winner 2006 prospective study of the biomechanical factors associated with iliotibial band syndrome. *Clin Biomech.* 2007;22(9):951-956. doi:10.1016/j.clinbiomech.2007.07.001.

57. Miller RH, Lowry JL, Meardon SA, Gillette JC. Lower extremity mechanics of iliotibial band syndrome during an exhaustive run. *Gait Posture*. 2007;26(3):407-413.
58. Rosenthal MD. Clinical testing for extra-articular lateral knee pain. A modification and combination of traditional tests. *N Am J Sports Phys Ther*. 2008;3(2):107-109.
59. Pegrum J, Self A HN, Hall N. Iliotibial band syndrome. *BMJ*. 2019;364:1980. doi: 10.1136/bmj.l980.
60. Gunter P, Schweltnus MP. Local corticosteroid injection in iliotibial band friction syndrome in runners: a randomised controlled trial. *Br J Sports Med*. 2004;38(3):269-272; discussion 272.
61. van der Worp MP, van der Horst N, de Wijer A, Backx FJG, Van Der Sanden MW. Iliotibial band syndrome in runners: a systematic review. *Sport Med*. 2012;42(11):969-992. doi:10.2165/11635400-000000000-00000.
62. Meardon SA, Derrick TR. Effect of step width manipulation on tibial stress during running. *J Biomech*. 2014;47(11):2738-2744. doi:10.1016/j.jbiomech.2014.04.047.
63. Beals C, Flanigan D. A Review of treatments for iliotibial band syndrome in the athletic population. *J Sports Med*. 2013. doi:10.1155/2013/367169.
64. Lopes AD, Hespanhol LC, Yeung SS, Costa LOP. What are the main running-related musculoskeletal injuries? A systematic review. *Sport Med*. 2012;42(10):891-905. doi:10.2165/11631170-000000000-00000.
65. Franklyn M, Oakes B. Aetiology and mechanisms of injury in medial tibial stress syndrome: current and future developments. *World J Orthop*. 2015;6(8):577-589. doi:10.5312/wjo.v6.i8.577.
66. Hamstra-Wright KL, Bliven KCH, Bay C. Risk factors for medial tibial stress syndrome in physically active individuals such as runners and military personnel: a systematic review and meta-analysis. *Br J Sports Med*. 2015;49(6):362-369. doi:10.1136/bjsports-2014-093462.
67. Winters M, Bakker EWP, Moen MH, Barten CC, Teeuwen R, Weir A. Medial tibial stress syndrome can be diagnosed reliably using history and physical examination. *Br J Sports Med*. 2018;52(19):1267-1272. doi:10.1136/bjsports-2016-097037.
68. Moen MH, Schmikli SL, Weir A, et al. A prospective study on MRI findings and prognostic factors in athletes with MTSS. *Scand J Med Sci Sport*. 2014;24(1):204-210. doi:10.1111/j.1600-0838.2012.01467.x.
69. Winters M. The diagnosis and management of medial tibial stress syndrome: an evidence update. *Unfallchirurg*. 2019;122(11):848-853. doi:10.1007/s00113-019-0667-z.
70. Winters M, Eskes M, Weir A, Moen MH, Backx FJG, Bakker EWP. Treatment of medial tibial stress syndrome: a systematic review. *Sport Med*. 2013;43(12):1315-1333. doi:10.1007/s40279-013-0087-0.
71. Winters M, Moen MH, Zimmermann WO, et al. The medial tibial stress syndrome score: a new patient-reported outcome measure. *Br J Sports Med*. 2016;50(19):1192-1199. doi:10.1136/bjsports-2015-095060.
72. Wilson F, Walshe M, O'Dwyer T, Bennett K, Mockler D, Bleakley C. Exercise, orthoses and splinting for treating Achilles tendinopathy: a systematic review with meta-analysis. *Br J Sports Med*. 2018;52(24):1564-1574. doi:10.1136/bjsports-2017-098913.
73. Maffulli N, Via AG, Oliva F. Chronic Achilles tendon disorders: Tendinopathy and chronic rupture. *Clin Sports Med*. 2015;34(4):607-624. doi:10.1016/j.csm.2015.06.010.
74. Maffulli N, Sharma P, Luscombe KL. Achilles tendinopathy: aetiology and management. *J R Soc Med*. 2004;97(10):472-476. doi:10.1258/jrsm.97.10.472.
75. Longo UG, Ronga M, Maffulli N. Achilles tendinopathy. *Sports Med Arthrosc*. 2018;26(1):16-30. doi:10.1097/JSA.000000000000185.
76. Rice H, Patel M. Manipulation of foot strike and footwear increases Achilles tendon loading during running. *Am J Sports Med*. 2017;45(10):2411-2417. doi:10.1177/0363546517704429.
77. McClinton S, Luedke L, Clewley D. Nonsurgical management of midsubstance Achilles tendinopathy. *Clin Podiatr Med Surg*. 2017;34(2):137-160. doi:10.1016/j.cpm.2016.10.004.
78. Franettovich Smith MM, Honeywill C, Wyndow N, Crossley KM, Creaby MW. Neuromotor control of gluteal muscles in runners with Achilles tendinopathy. *Med Sci Sports Exerc*. 2014;46(3):594-599. doi:10.1249/MSS.000000000000133.
79. Alfredson H, Pietilä T, Jonsson P, Lorentzon R. Heavy-load eccentric calf muscle training for the treatment of chronic Achilles tendinosis. *Am J Sports Med*. 1998;26(3):360-366. doi:10.1177/03635465980260030301.
80. Petraglia F, Ramazzina I, Costantino C. Plantar fasciitis in athletes: diagnostic and treatment strategies. A systematic review. *Muscles Ligaments Tendons J*. 2017;7(1):107-118. doi:10.11138/mltj/2017.7.1.107.
81. Wu CH, Chang KV, Mio S, Chen WS, Wang TG. Sonoelastography of the plantar fascia. *Radiology*. 2011;259(2):502-507. doi:10.1148/radiol.11101665.
82. De Garceau D, Dean D, Requejo SM, Thordarson DB. The association between diagnosis of plantar fasciitis and Windlass test results. *Foot Ankle Int*. 2003;24(3):251-255.
83. Goff JD, Crawford R. Diagnosis and treatment of plantar fasciitis. *Am Fam Physician*. 2011;84(6):676-682.
84. Martin RL, Davenport TE, Reischl SF, et al. Heel pain - plantar fasciitis: revision 2014. *J Orthop Sports Phys Ther*. 2014;44(11):A1-33. doi:10.2519/jospt.2014.0303.
85. Thompson JV, Saini SS, Reb CW, Daniel JN. Diagnosis and management of plantar fasciitis. *J Am Osteopath Assoc*. 2014;114(12):900-906. doi:10.7556/jaoa.2014.177.

114. Joseph MF, Taft K, Moskwa M, Denegar CR. Deep friction massage to treat tendinopathy: a systematic review of a classic treatment in the face of a new paradigm of understanding. *J Sport Rehabil.* 2012;21(4):343-353. doi:10.1123/jsr.21.4.343.
115. Wiewelhove T, Döweling A, Schneider C, et al. A meta-analysis of the effects of foam rolling on performance and recovery. *Front Physiol.* 2019 Apr 9;10:376. doi:10.3389/fphys.2019.00376.
116. Cheatham SW, Stull KR. Comparison of a foam rolling session with active joint motion and without joint motion: a randomized controlled trial. *J Bodyw Mov Ther.* 2018;22(3):707-712. doi:10.1016/j.jbmt.2018.01.011.
117. Cook JL, Docking SI. Rehabilitation will increase the “capacity” of your -insert musculoskeletal tissue here. Defining “tissue capacity”: a core concept for clinicians. *Br J Sports Med.* 2015;49(3):1484-1485. doi:10.1136/bjsports-2015-094849.
118. Lack S, Barton C, Sohan O, Crossley K, Morrissey D. Proximal muscle rehabilitation is effective for patellofemoral pain: a systematic review with metaanalysis. *Br J Sports Med.* 2015;49(21):1365-1376. doi:10.1136/bjsports-2015-094723.
119. Murtaugh B, Ihm JM. Eccentric training for the treatment of tendinopathies. *Curr Sports Med Rep.* 2013;12(3):175-182. doi:10.1249/JSR.0b013e3182933761.
120. Rees JD, Lichtwark GA, Wolman RL, Wilson AM. The mechanism for efficacy of eccentric loading in Achilles tendon injury; an in vivo study in humans. *Rheumatology (Oxford).* 2008;47(10):1493-1497. doi:10.1093/rheumatology/ken262.
121. Stanish WD, Rubinovich RT, Curwin S. Eccentric exercise in chronic tendinitis. *Clin Orthop Relat Res.* 1986;(208):65-68.
122. Malliaras P, Cook J, Purdam C, Rio E. Patellar tendinopathy: Clinical diagnosis, load management, and advice for challenging case presentations. *J Orthop Sports Phys Ther.* 2015;45(11):887-898. doi:10.2519/jospt.2015.5987.
123. Sherry MA, Johnston TS, Heiderscheid BC. Rehabilitation of acute hamstring strain injuries. *Clin Sports Med.* 2015;34(2):263-284. doi:10.1016/j.csm.2014.12.009.
124. Barbaras J, Barrie B. Welcome to the resistance. American Physical Therapy Association combined sections meeting, Washington DC, January 25, 2019.
125. Beyer R, Kongsgaard M, Hougs Kjær B, Øhlenschläger T, Kjær M, Magnusson SP. Heavy slow resistance versus eccentric training as treatment for Achilles tendinopathy. *Am J Sports Med.* 2015;43(7):1704-1711. doi:10.1177/0363546515584760.
126. Mosti MP, Carlsen T, Aas E, Hoff J, Stunes AK, Syversen U. Maximal strength training improves bone mineral density and neuromuscular performance in young adult women. *J Strength Cond Res.* 2014;28(10):2935-2945. doi:10.1519/JSC.0000000000000493.
127. Taipale RS, Schumann M, Mikkola J, et al. Acute neuromuscular and metabolic responses to combined strength and endurance loadings: the “order effect” in recreationally endurance trained runners. *J Sports Sci.* 2014;32(2):1155-1164. doi:10.1080/02640414.2014.889842.
128. Beattie K, Carson BP, Lyons M, Rossiter A, Kenny IC. The effect of strength training on performance indicators in distance runners. *J Strength Cond Res.* 2017;30(1):9-23. doi:10.1519/JSC.0000000000001464.
129. Harrast MA, Colonna D. Stress fractures in runners. *Clin Sports Med.* 2010;29(3):399-416. doi:10.1016/j.csm.2010.03.001.
130. The Ohio State University/Wexner Medical Center, Sports Medicine Rehabilitation Protocols. Basic return to running rehabilitation guideline. Available at: <https://wexnermedical.osu.edu/-/media/files/wexnermedical/patient-care/healthcare-services/sports-medicine/education/medical-professionals/other/basicreturntorunning.pdf?la=en&hash=FDB393C11EC5A4EA90A5934FE-3419B267C5ACDFE>. Accessed August 20, 2019.
131. Liem BC, Truswell HJ, Harrast MA. Rehabilitation and return to running after lower limb stress fractures. *Curr Sports Med Rep.* 2013;12(3):200-207. doi:10.1249/JSR.0b013e3182913cbe.
132. Pollard CD, Ter Har JA, Hannigan JJ, Norcross MF. Influence of maximal running shoes on biomechanics before and after a 5K run. *Orthop J Sport Med.* 2018;6(6):2325967118775720. doi:10.1177/2325967118775720.
133. Law MHC, Choi EMF, Law SHY, et al. Effects of footwear midsole thickness on running biomechanics. *J Sports Sci.* 2019;37(9):1004-1010. doi:10.1080/02640414.2018.1538066.
134. Napier C, Willy RW. Logical fallacies in the running shoe debate: let the evidence guide prescription. *Br J Sports Med.* 2018;52(24):1552-1553. doi:10.1136/bjsports-2018-100117.
135. Esculier JF, Dubois B, Dionne CE, Leblond J, Roy JS. A consensus definition and rating scale for minimalist shoes. *J Foot Ankle Res.* 2015;8:42. doi:10.1186/s13047-015-0094-5.
136. Coetzee DR, Albertus Y, Tam N, Tucker R. Conceptualizing minimalist footwear: an objective definition. *J Sports Sci.* 2018;36(8):949-954. doi:10.1080/02640414.2017.1346816.
137. Hamill J, Gruber AH. Is changing footstrike pattern beneficial to runners? *J Sport Heal Sci.* 2017;6(2):146-153. doi:10.1016/j.jshs.2017.02.004.
138. Chan ZYS, Au IPH, Lau FOY, Ching ECK, Zhang JH, Cheung RTH. Does maximalist footwear lower impact loading during level ground and downhill running? *Eur J Sport Sci.* 2018;18(8):1083-1089. doi:10.1080/17461391.2018.1472298.