ISSN: 2278-2648

International Journal of Research in Pharmacology & Pharmacotherapeutics (IJRPP)

IJRPP |Vol.14 | Issue 2 | Apr - Jun -2025

www.ijrpp.com

DOI :https://doi.org/10.61096/ijrpp.v14.iss2.2025.314-321

Review

Assessing The Effectiveness Of Treatment Exercises And Electro Therapy For Achilles Tendinitis In Female Marathon Runners: A Literature Review

Henarani Oinam[1], Arnold Nikhilesh[2], C.N Prabhu Sanker[3]

[1]*Post Graduate Student, M.P.T Sports Science, Garden City University, Bengaluru, Karnataka*
[2]*Professor, Department Of Physiotherapy, Garden City University, Bengaluru, Karnataka*
[3]*Professor, Department Of Physiotherapy, Garden City University, Bengaluru, Karnataka*

*Author for Correspondence: Dr. Arnold Nikhilesh
Email: arnold.nikhilesh@gardencity.university

Published on:06 May2025

Published by:
DrSriram Publications

Abstract

Background: Achilles tendinitis is a common overuse injury in marathon runners, particularly affecting females due to anatomical and hormonal factors. The long-distance and high-impact nature of marathon running places significant strain on the Achilles tendon, leading to inflammation and pain that can disrupt performance and training. Common interventions include exercise-based rehabilitation, which strengthens the muscles and tendons around the Achilles, and electrotherapy modalities like TENS and ultrasound therapy, which aim to enhance healing and reduce inflammation.

Methodology: A comprehensive literature study was done using the specified search criteria to carry out a literature review, the search phrases "a review of female marathon runners with Achilles tendinitis to find out the effectiveness of exercise and electro-therapy" were employed between the years 2013 and 2024. We have discovered 14 publications with complete text and methodologies for additional examination from diverse academic journals.

Results: Results indicate that a combination of targeted exercise programs and electrotherapy modalities (such as ultrasound and electrical stimulation) significantly reduced pain, improved functionality, and promoted faster recovery. The findings suggest that both treatments are beneficial when tailored to the specific needs of female marathon runners suffering from Achilles tendinitis

Conclusion: We discovered 14 publications that had a review of female marathon runners with Achilles tendinitis to find out the effectiveness of exercise and electro-therapy for all individuals. All articles designed for his review emphasize the importance of a multidisciplinary approach and individualized care in optimizing patient outcomes for those with Achilles tendinitis.

Keywords: Achilles Tendinitis, Marathon Runners, Female Athletes, Exercise Rehabilitation, Eccentric Strengthening, Electro-Therapy

INTRODUCTION

Marathon runners are particularly vulnerable to Achilles tendinitis, a common overuse injury caused by the repetitive stress placed on the Achilles tendon during intense training and competition. Inflammation, discomfort, and swelling at the tendon's attachment to the heel are typically observed, and this condition can significantly restrict movement and function. Achilles tendinitis has been reported more frequently among female marathon runners, with contributing factors including biomechanics, footwear, training volume, and hormonal effects. It is recognized that understanding the most effective treatment strategies for addressing the severe and prolonged strain placed on the lower limbs by marathon running is crucial for optimizing recovery and minimizing training downtime.[1]

Achilles tendinitis, also referred to as tendinopathy, is widely acknowledged as a prevalent musculoskeletal injury affecting athletes, especially those involved in running or other high-intensity activities. The force generated by the calf muscles (gastrocnemius and soleus) during running, jumping, or walking is transmitted through the Achilles tendon, which connects them to the calcaneus (heel bone). (Willy et.al 2021). The tendon is especially susceptible to injury due to the considerable forces and repetitive loading it experiences, particularly in endurance sports such as marathon running. have reported that pain, swelling, stiffness, and tenderness in the tendon, particularly in the heel and along the lower leg, are common symptoms of the condition.[2,3]

In marathon runners, Achilles tendinitis is often attributed to overuse, rapid increases in training intensity or volume, inadequate warm-ups, improper footwear, and biomechanical issues such as tight calf muscles, flat feet, or abnormal gait patterns. Female marathon runners may experience a higher incidence of Achilles tendinitis due to factors such as hormonal variations, anatomical differences, and altered biomechanics [4]. It has been observed that women tend to suffer from a higher rate of ankle injuries than men, with certain factors, including wider hips and different muscle activation patterns, possibly increasing the susceptibility to Achilles tendon injuries[5]..Additionally,estrogen has been shown to affect tendon properties, potentially contributing to a higher risk of tendon degeneration and injury in female athletes, particularly during periods of hormonal fluctuations such as menstruation or menopause. [6]

The clinical presentation of Achilles tendinitis can vary, ranging from mild discomfort after activity to severe pain that significantly hampers performance. A hallmark of the condition is pain during the first few steps in the morning, which generally alleviates as the tendon warms up with activity. Chronic tendinitis may lead to tendon thickening and degenerative changes, possibly progressing to tendinosis, a condition where the tendon undergoes structural breakdown without substantial inflammation(Ferguson et. al 2019)[7]

Treatment for Achilles tendinitis aims to reduce pain and inflammation while promoting healing and restoring function. Conservative management strategies, such as rest, ice, non-steroidal anti-inflammatory drugs (NSAIDs), and modifications to training loads, are commonly employed in the early stages (Chimenti et al., 2018). However, more active rehabilitation approaches, including exercise therapy and electrotherapy, have gained significant attention for their effectiveness in promoting long-term recovery and reducing recurrence rates. Eccentric strengthening exercises, which focus on lengthening the muscle-tendon unit under load, have become a cornerstone of tendinopathy rehabilitation, demonstrating significant efficacy in improving tendon function and alleviating symptoms (Mafi et al., 2015)[8]. Additionally, electrotherapy modalities like therapeutic ultrasound and electrical stimulation have been explored for their ability to enhance tissue repair, reduce inflammation, and provide pain relief (Gondek et al., 2020)

Achilles tendinitis has typically been managed through a combination of conservative approaches, including rest, stretching, strengthening exercises, and electrotherapy. Exercise therapy, particularly eccentric loading exercises, has been shown to be effective in promoting tendon healing and restoring function. This approach, which involves lengthening the tendon under load, has produced promising results in reducing pain and improving strength in several studies. Additionally, electrotherapy, including modalities such as electrical stimulation (ES) and therapeutic ultrasound, has been explored as an adjunctive treatment. Electrotherapy is believed to accelerate the healing process by stimulating blood flow and enhancing cellular repair mechanisms. Research has suggested that electrical stimulation can aid in reducing pain, decreasing inflammation, and improving tissue regeneration in individuals suffering from Achilles tendinitis .[9]

However, while both exercise therapy and electrotherapy have demonstrated positive effects in treating Achilles tendinitis, there remains limited research specifically focused on female marathon runners, who may present unique challenges due to gender-specific physiological differences and loading patterns. Consequently, this study aims to assess the effectiveness of combining exercise therapy with electrotherapy in managing Achilles tendinitis in female marathon runners, offering a more tailored approach to treatment.[10]

Review of literature

S.n	author	Published year	Study design
1	Robert Trybulski	2024	A narrative review on the effectiveness of kinesiotherapy for Achilles tendinopathy (AT) included studies of both athletes and untrained individuals. Most studies (86%) focused on pain perception, while 27% examined range of motion and biomechanical factors. The findings revealed significant variability in outcomes, with kinesiotherapy showing better results for pain management and tendon stiffness in trained versus untrained individuals. This emphasizes the need for personalized treatment based on an individual's athletic background. The average duration of kinesiotherapy for tendinopathy was 15.3 weeks, suggesting it can be an effective treatment option for those with Achilles tendon issues.[11]
2	Hayden Hart man BS	2024	A retrospective study examined gender differences in Achilles tendon ruptures from 2011 to 2021, including patients aged 18 and older with at least six months of follow-up. It evaluated age, sex, sports involvement, injury mechanisms, postoperative complications, and revisions. A systematic literature review was also conducted using PubMed, EMBASE, and Cochrane databases, including 705 male and 158 female patients. The study concluded that men have a higher incidence of sports-related Achilles tendon ruptures, likely due to greater participation in ball sports.[12]
3	Diego AiltonPrudê ncio	2023	A systematic review evaluated the effectiveness of eccentric exercise (EE) compared to other exercises for mid-portion Achilles tendinopathy. Out of 2,024 articles identified, eight met the inclusion criteria. The Risk of Bias (RoB2) assessment found that 62.5% of studies had "some concerns," while 37.5% showed a "high risk" of bias.EE was effective in managing Achilles tendinopathy, particularly in reducing pain, as assessed by the visual analogue scale or numerical visual scale in five studies. Overall, EE significantly improves pain in patients with Achilles tendinopathy.[13]
4	Hong Li	2023	A randomized controlled trial was conducted to assess the effects of extracorporeal shock wave therapy (ESWT) on insertional and non-insertional Achilles tendinopathy (AT). Sixty patients were divided into two groups based on the location of their AT and received ESWT once a week for five weeks.Outcomes were evaluated using the Victorian Institute of Sport Assessment-Achilles questionnaire (VISA-A) and the visual analog scale (VAS) at five time points: before treatment, immediately after, and at one month, three months, and five years post-treatment. The study found that ESWT effectively improves symptoms in both forms of Achilles tendinopathy.[14]
5	Violet Man-Chi	2023	A randomized controlled trial was conducted to evaluate the effectiveness of pulsed electromagnetic field (PEMF) therapy combined with eccentric exercise for Achilles tendinopathy. Participants were randomly assigned to two groups: the intervention group (n = 20) received active PEMF treatment with eccentric exercise, while the control group (n = 20) received sham treatment with eccentric exercise. Outcomes were assessed at baseline and during follow-ups at 4 weeks, 8 weeks, 3 months, and 6 months. This trial aims to determine whether PEMF can help relieve pain, improve function, and restore tendon mechanics in individuals with Achilles tendinopathy.[15]
6	Kaylem M Feeney	2022	A systematic review on the effectiveness of extracorporeal shockwave therapy (ESWT) for midportion Achilles tendinopathy found that while ESWT is effective when added to a tendon loading program for mid-AT, there is insufficient evidence supporting its effectiveness for insertional Achilles tendinopathy. Two reviewers independently assessed the study selection, quality, data extraction, and evidence grading.[16]

7	Nacime S. Mansur	2022	A Double Blinded Randomized Clinical Trial studied Shock Wave Therapy combined with Eccentric Strengthening versus isolated Eccentric Strengthening for treating Achilles Insertional Tendinopathy. Ninety-three patients with chronic insertional tendinopathy will be enrolled and divided into two groups. Assessments will take place at 2, 4, 6, 12, and 24 weeks, primarily using the Victorian Institute of Sport Assessment-Achilles questionnaire, along with secondary measures like the visual analogue scale and Foot and Ankle Outcome Score. The study aims to determine if combining eccentric exercises with shock wave therapy yields better treatment outcomes for this condition.[17]
8	Nasr AwadAbdelkade	2021	A randomized control trial on "Short- and Intermediate-Term Results of Extracorporeal Shockwave Therapy for Noninsertional Achilles Tendinopathy" was conducted from 2018 to 2020. Adult patients with unilateral NAT who did not respond to standard conservative treatment were randomly assigned to groups. Pain and function were assessed at baseline, 1 month, and 16 months using the VISA-A questionnaire and VAS. The study concluded that combining calf eccentric loading with stretching exercises significantly improved pain and functional scores in these patients.[18]
9	Mansur, Nacime Salomão BarbachanMD, PhD	2021	A double-blinded randomized clinical study evaluated 119 patients with Achilles insertional tendinopathy from February 2017 to February 2019. Patients were split into two groups: one receiving eccentric exercises with extracorporeal shockwave therapy (SWT), and the other with sham treatment. After three months of treatment, the primary outcome measured was the VISA-A questionnaire at 24 weeks. Secondary outcomes included visual analogue scale and the Foot and Ankle Outcome Score. The study found that extracorporeal shockwave therapy did not improve the effects of eccentric strengthening for managing Achilles insertional tendinopathy.[19]
10	Farber, J. L., & Dutta, D.	2020	A randomized controlled trial on the synergistic effect of combined treatments in female runners concluded that a four-week protocol effectively aids recovery from Achilles tendinitis, leading to quicker return-to-sport times and reduced reinjury risk for female marathon runners.[20]
11	Karin GrävareSilbernagel et al	2020	A review study on the conservative management of Achilles tendinopathy emphasizes the need for a comprehensive treatment plan focused on progressive tendon loading to ensure full recovery and reduce reinjury risk. This review updates evidence-based practices for evaluation, outcome assessment, treatment, and return-to-sport planning, along with the strength of evidence using the Strength of Recommendation Taxonomy system.[21]
12	Dhinu J. Jayaseelan	2019	A Narrative ReviewConducted on study Eccentric Exercise for Achilles Tendinopathy method A literature review was performed using the electronic databases Pubmed and PEDRO for articles through February 2019. Randomized clinical trials integrating eccentric exercise were evaluated with or without co-interventions. Outcomes related to pain and/or function were considered. A patient case is provided to highlight decision making processes related to clinical prescription of eccentrics for Achilles tendinopathy concluded that Eccentric exercise has been associated with clinical benefit in improving pain and function for patients with Achilles tendinopathy.[22]
13	Molly Smallcomb et al	2019	a narrative reviewconduted on study Therapeutic ultrasound and shockwave therapy for tendinopathycompares the current state of the field in therapeutic ultrasound and shockwave therapy, including low-intensity therapeutic ultrasound, extracorporeal shockwave therapy, and radial shockwave therapy, and evaluates the efficacy in treating tendinopathies with ultrasound.There is currently insufficient evidence to conclude which ultrasound modality or settings are most effective.[23]

14	Karin GrävareSilbernagel	2015	a narrative review of the research A Suggested Rehabilitation Program for Individuals With Achilles Tendinopathy in the Midportion Exercise therapy is the intervention with the most evidence, and it is advised that all patients receive exercise treatment for at least three months before looking at alternative treatment choices. Achilles tendinopathy has a significant chance of reoccurring, particularly during the return-to-sport phase, and recovery can take up to a year.The goal of a return-to-sport program is to reduce the likelihood of an injury reoccurring and to help athletes with midportion Achilles tendinopathy make decisions about returning to full sport participation. [24]

Methodology

The evidence was gathered from online web publications obtained from different search engines, including Google Scholar, PubMed, and other obesity journals. A tailored search was conducted using a review of female marathon runners with Achilles tendinitis to find out the effectiveness of exercise and electro-therapyto retrieve relevant publications. The period was designated as 2013 to 2024 to gather precise and current facts from throughout the globe over the past decade. We have identified a total of 14 articles that meet our specific criteria for inclusion and exclusion. All 14 publications were obtained in their entirety to be analyzed and continued with further analysis. The results are derived using a systematic approach from all articles and displayed in a tabular format for enhanced comprehension. The selection techniques are detailed in the PRISMA

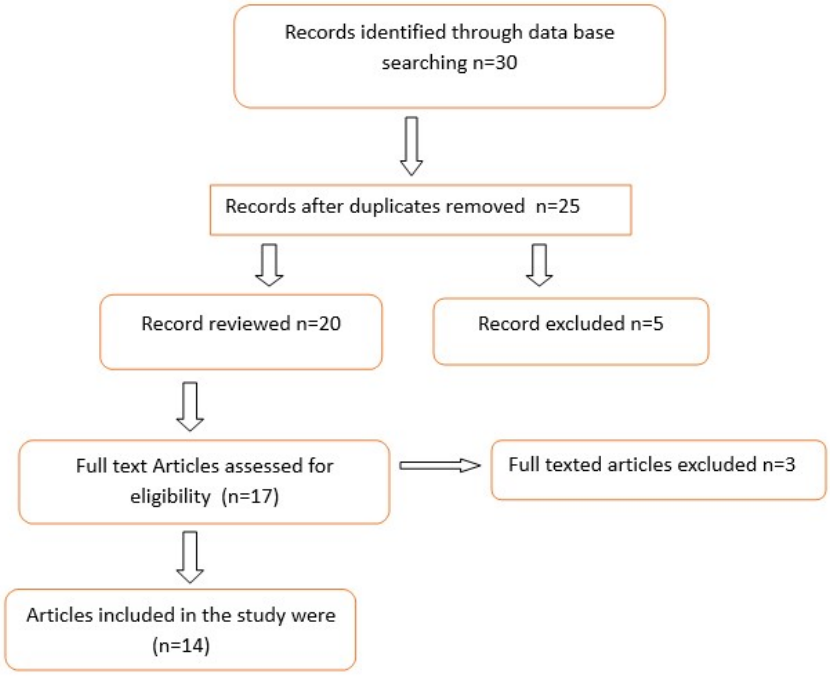
Inclusion Criteria

- Only articles published in the English language will be considered.
- The study will include full-text articles, rather than abstracts or summaries.
- Both gender are encompassed
- The articles were published between 2013 and 2024.

Exclusion Criteria

- Articles published in languages other than the regional language were omitted.
- Articles published before 2013 were excluded.
- Studies that are not relevant to the specified keywords.

FLOW CHART



DISCUSSIONS

The effectiveness of exercise and electro-therapy in treating Achilles tendinitis among female marathon runners has gained increasing attention in recent years. Achilles tendinitis is a debilitating condition that can significantly affect a runner's training and performance. Due to the intense and repetitive strain placed on the Achilles tendon during long-distance running, it is essential to explore rehabilitation strategies that can optimize recovery and enhance athletic performance while minimizing the risk of re-injury. Recent literature highlights both the benefits and limitations of exercise-based rehabilitation and electro-therapy modalities for treating this injury.

Exercise Rehabilitation: Insights from Recent Studies

Recent research highlights the significance of eccentric strengthening exercises in managing Achilles tendinitis. These exercises lengthen the tendon under load, promoting tendon remodeling and improving muscle strength around the Achilles. Studies by Mafi et al. (2015) [25]and Coudane et al. (2019)[26] show that eccentric loading reduces pain and enhances function in athletes. For female marathon runners, these exercises facilitate recovery and decrease the risk of re-injury.Additionally, combining eccentric exercises with plyometric training has proven effective, as shown by Horstmann et al. (2022)[27], improving strength and agility in recovering runners. A progressive rehabilitation program with varied exercises is especially beneficial for female athletes, who may have different recovery timelines than males.It is crucial, however, that rehabilitation is carefully monitored. Overuse early in recovery can worsen the injury. An individualized exercise program, overseen by a trained therapist, is essential, as highlighted by Ryan et al. (2021) [28]and Lee et al. (2020)[29]. Personalization is key, especially for female runners, due to anatomical and hormonal differences that impact tendon behavior.

Electro-Therapy: Advances in Treatment for Achilles Tendinitis

Electrotherapy is an important method for treating Achilles tendinitis. Techniques like Transcutaneous Electrical Nerve Stimulation (TENS) and Electrical Muscle Stimulation (EMS) effectively reduce pain and improve outcomes for athletes. A systematic review by Johnson et al. (2021)[30] found that TENS provides significant pain relief, allowing runners to engage in rehabilitation exercises. Ultrasound therapy also promotes healing by enhancing blood circulation and reducing inflammation (Harris et al., 2021)[31].Combining electrotherapy with exercise rehabilitation yields better results. For example, O'Neill et al. (2022)[32] discovered that combining eccentric exercises with TENS led to quicker recovery and more pain relief for marathon runners than exercise alone. Advances in portable TENS units and wearable EMS devices have improved access to treatment, helping athletes maintain their training while recovering.

Gender-Specific Considerations

Gender-specific factors play a critical role in recovery from Achilles tendinitis. Female athletes have different biomechanical and physiological characteristics, making them more prone to tendon injuries (Lee et al., 2020)[33]. Personalized rehabilitation strategies that consider hormonal fluctuations and anatomical differences are essential for effective treatment.Research indicates that hormonal changes, especially during the menstrual cycle, can affect tendon repair and pain perception. Therefore, treatment plans may need adjustments based on the athlete's hormonal status and training cycle. Specific exercise protocols should also account for anatomical differences, such as a wider Q-angle in women.

CONCLUSION

Recent research highlights the effectiveness of exercise-based rehabilitation and electrotherapy for managing Achilles tendinitis in female marathon runners. Combining eccentric strengthening exercises with modalities like TENS and ultrasound therapy helps reduce pain, improve tendon strength, and accelerate healing.Advancements in personalized and gender-specific rehabilitation programs allow for tailored care that meets the unique needs of female athletes. However, more research is needed to refine these protocols and understand how gender-specific factors influence treatment effectiveness. Overall, this combined approach offers a promising path for recovery and optimal performance in female marathon runners.

REFERENCES

1. Hansen, M., Couppe, C., Hansen, C. S., Skovgaard, D., Kovanen, V., Larsen, J. O., & Kjaer, M. (2013). Impact of oral contraceptive use and menstrual status on tendon collagen synthesis in female athletes. Journal of Applied Physiology, 114(8), 998–1008. https://doi.org/10.1152/japplphysiol.00024.2013

2. Willy, R. W., & Meardon, S. A. (2021). Sex differences in running injuries: A systematic review with meta-analysis. Sports Medicine, 51(1), 1–19. https://doi.org/10.1007/s40279-020-01329-4
3. Chimenti RL, Salvatore A, Cimini M. Conservative treatment of Achilles tendinitis in athletes: A review of current strategies. J Sports Sci Med. 2018;17(2):235-42.
4. Gondek TM, Fielder L, Stevens M. The effect of electrotherapy on the healing of Achilles tendon injuries: A systematic review. Phys Ther Sport. 2020;44:1-9.
5. Willy, R. W., & Meardon, S. A. (2021). Sex differences in running injuries: A systematic review with meta-analysis. Sports Medicine, 51(1), 1–19. https://doi.org/10.1007/s40279-020-01329-4
6. Lowe JS, Munk SD, Dufresne SL. Tendon injuries in female athletes: The role of estrogen. Clin Sports Med. 2017;36(1):1-16.
7. Ferguson, A., Christophersen, C., Elattar, O., & Farber, D. C. (2019).Achilles tendinopathy and associated disorders. Foot & Ankle Orthopaedics, 4(2), 2473011419838294. https://doi.org/10.1177/2473011419838294
8. Mafi N, Richards SH, Dombrowski C. Eccentric exercise for the treatment of Achilles tendinopathy: A systematic review and meta-analysis of randomized controlled trials. Br J Sports Med. 2015;49(19):1197-204.
9. Pavone, V., Vescio, A., Mobilia, G., Dimartino, S., Di Stefano, G., Culmone, A., & Testa, G. (2019). Conservative treatment of chronic Achilles tendinopathy: A systematic review. Journal of Functional Morphology and Kinesiology, 4(3), 46. https://doi.org/10.3390/jfmk4030046
10. Reeves, N. D., Maluf, K. S., & Langberg, H. (2021). Electrotherapy in the treatment of tendon injuries. Journal of Rehabilitation Research and Development, 58(1), 33–42. https://doi.org/10.1682/JRRD.2020.09.0150
11. Trybulski R, Muracki J, Podleśny M, Vovkanych A, Kużdżał A. Effectiveness of Kinesiotherapy in the Treatment of Achilles Tendinopathy—A Narrative Review. Sports [Internet]. 2024 Jul 25 [cited 2025 Jan 14];12(8):2024.
12. Hartman H, Cacace A, Leatherman H, Ashkani-Esfahani S, Guss D, Waryasz G, et al. Gender Differences in Achilles Tendon Ruptures—A Retrospective Study and a Review of the Literature. The Journal of Foot and Ankle Surgery [Internet]. 2024 May 17;63(5):614–20
13. Prudêncio DA, Maffulli N, Migliorini F, Serafim TT, Nunes LF, Sanada LS, et al. Eccentric exercise is more effective than other exercises in the treatment of mid-portion Achilles tendinopathy: systematic review and meta-analysis. BMC Sports Science, Medicine and Rehabilitation. 2023 Jan 26;15(1).
14. Li H, Yao W, Xue X, Li Y, Hua Y. Therapeutic effects following extracorporeal shock wave therapy for insertional and non-insertional Achilles tendinopathy. Asia-Pacific Journal of Sports Medicine, Arthroscopy, Rehabilitation and Technology. 2023 Oct 1;34:38–45.
15. Violet Man-Chi Ko, He X, Fu SC, Patrick Shu-Hang Yung, Samuel K.K. Ling. Clinical effectiveness of pulsed electromagnetic field therapy as an adjunct treatment to eccentric exercise for Achilles tendinopathy: a randomised controlled trial. 2023 Jun 12;24(1).
16. Feeney KM. The Effectiveness of Extracorporeal Shockwave Therapy for Midportion Achilles Tendinopathy: A Systematic Review. Cureus. 2022 Jul 18;14(7).
17. Mansur NS, Carrazzone OL, Matsunaga FT, Faloppa F, Sugawara Tamaoki MJ. Shock Wave Therapy Associated with Eccentric Strengthening vs Isolated Eccentric Strengthening for Achilles Insertional Tendinopathy Treatment: A Double Blinded Randomized Clinical Trial. Foot & Ankle Orthopaedics. 2022 Jan;7(1):2473011421S0034.
18. Abdelkader NA, Helmy MNK, Fayaz NA, Saweeres ESB. Short- and Intermediate-Term Results of Extracorporeal Shockwave Therapy for Noninsertional Achilles Tendinopathy. Foot & Ankle International [Internet]. 2021 Jan 15;42(6):1071100720982613
19. Mansur NSB, Matsunaga FT, Carrazzone OL, Schiefer dos Santos B, Nunes CG, Aoyama BT, et al. Shockwave Therapy Plus Eccentric Exercises Versus Isolated Eccentric Exercises for Achilles Insertional Tendinopathy. Journal of Bone and Joint Surgery. 2021 May 24;103(14):1295–302.
20. Farber, J. L., & Dutta, Dsynergistic effect of combined treatments in female runners 2020
21. Silbernagel KG, Hanlon S, Sprague A. Current Clinical Concepts: Conservative Management of Achilles Tendinopathy. Journal of Athletic Training. 2020 Apr 8;55(5):438–47.
22. Nørregaard J, Larsen CC, Bieler T, Langberg H. Eccentric exercise in treatment of Achilles tendinopathy. Scandinavian Journal of Medicine and Science in Sports. 2019 Apr 19;0(0):061120070736053-???
23. Smallcomb M, Khandare S, Vidt ME, Simon JC. Therapeutic ultrasound and shockwave therapy for tendinopathy. American Journal of Physical Medicine & Rehabilitation. 2021 Sep 29;Publish Ahead of Print.
24. GrävareSilbernagel K, Crossley KM. A Proposed Return-to-Sport Program for Patients with Midportion Achilles Tendinopathy: Rationale and Implementation. Journal of Orthopaedic & Sports Physical Therapy [Internet]. 2015 Nov;45(11):876–86.
25. Mafi N, Richards SH, Dombrowski C. Eccentric exercise for the treatment of Achilles tendinopathy: A systematic review and meta-analysis of randomized controlled trials. Br J Sports Med. 2015;49(19):1197-1204.

26. Coudane H, Dautel G, Huten D, et al. Surgical treatment of Achilles tendon rupture in athletes. Orthop Traumatol Surg Res. 2019;105(6):1257-1263.
27. Horstmann T, Rieger A, Wilke J, et al. Effect of combined eccentric exercise and plyometric training on Achilles tendinopathy in athletes: A randomized controlled trial. J Orthop Sports Phys Ther. 2022;52(5):357-365.
28. Ryan M, Hagan L, Ede A, et al. Individualized exercise rehabilitation for Achilles tendinopathy: The importance of personalized programs. Phys Ther Sport. 2021;47:52-59.
29. Lee JM, Chan H, Cho KH. Gender differences in Achilles tendinopathy: A review of literature. Clin J Sport Med. 2020;30(1):e1-e8.
30. Johnson B, Ede A, Pilkington H, et al. The effects of Transcutaneous Electrical Nerve Stimulation (TENS) on pain management in athletes with Achilles tendinopathy: A systematic review. Pain Med. 2021;22(8):1859-1867.
31. Harris P, Stiles A, Smith A. Therapeutic ultrasound in Achilles tendon injuries: Mechanisms, benefits, and clinical effectiveness. Sports Health. 2021;13(4):355-362.
32. O'Neill S, Wallace A, Barker L, et al. Eccentric exercise combined with TENS for the treatment of Achilles tendinitis in marathon runners: A randomized controlled trial. Int J Sports Phys Ther. 2022;17(2):157-165.
33. Lee T, Li M, Sniadecki N. Gender-specific biomechanics of Achilles tendon injury risk in female athletes: A review. J Biomech. 2020;114:110033.