International Journal of Kinesiology & Sports Science
ISSN: 2202-946X
www.ijkss.aiac.org.au

Effects of Tissue Flossing with Foam Roller on Pain and Lower Extremity Function in Medial Tibial Stress Syndrome

Anshika Singh[1], DharamChand[2], Brijesh Prajapati[3], Yamuni Bhandari[3], Piyush Bhardwaj[3], Sumit Raghav[3], Shagun Agarwal[3]*, Venkata Nagaraj Kakraparthi[4]

[1]*School of Allied Health Sciences, Galgotias University, Greater Noida, Uttar Pradesh, India*

[2]*Swami Vivekanand Subharti University, Meerut, India*

[3]*School of Allied Health Sciences, Galgotias University, Greater Noida, Uttar Pradesh, India,*

[4]*College of Applied Medical Sciences, King Khalid University, Saudi Arabia*

Corresponding Author: Shagun Agarwal, E-mail: shagunmpt@gmail.com

ARTICLE INFO

Article history
Received: January 01, 2025
Revised: February 25, 2025
Accepted: April 12, 2025
Published: April 30, 2025
Volume: 13 Issue: 2

Conflicts of interest: The authors declare no competing interests.
Funding: This research received no external funding.

ABSTRACT

Background: Medial Tibial Stress Syndrome (MTSS) is identified as the most prevalent musculoskeletal injury among athletes, with an incidence rate between 13.6% and 20%, and a prevalence of 9.5%. **Objective:** The purpose of this study was to find the effects of tissue flossing with foam roller in medial tibial stress syndrome. **Methods:** This is a simple pre and post experimental design study. Two groups of 60 participants (30 athletes each) were allocated to the tissue flossing with foam roller group (group 1) and the ice massage with stretching exercise group (group 2). Difference in outcome scores were measured at the first day of treatment and five weeks later. **Results:** With an NPRS score of (3.8±1.2) compared to the group-2 (4.5±1.0), an LEFS score of 69.2±5.7 compared to the group-2 (66.4±5.6), and an MTSS score of (2.8±1.5) compared to the group-2 (3.9±1.4), the group-1 showed the mean difference improvement. **Conclusion:** Group 1 outperformed Group 2 in terms of the mean difference in NPRS, LEFS, and MTSS scores. The management of MTSS may involve tissue flossing along with foam rolling.

Key words*:* Medial Tibial Stress Syndrome, Tissue Flossing, Stretching Exercises, Pain

INTRODUCTION

Bone tissue cracks and fractures are a serious issue that are linked to medical conditions and treatment costs. Throughout a person's lifespan, their bones are subject to both static and dynamic external stresses. A phenomenon called a fatigue state can be produced by repeated loadings, even though a little amount of loading does not always result in fracture. Medial Tibial Stress Syndrome (MTSS) is one type of bone fatigue injury (Jasty et al., 2021). MTSS is a painful disorder described as post-activity discomfort (Deshmukh & Phansopkar, 2022). MTSS are a common overuse sports ailment, with incidence rates ranging from 4% to 19% in athletic groups and 4% to 35% in the military population (Yagi S et al., 2013). The most prevalent associated musculoskeletal injury is MTSS among runners with diverse incidence rate. MTSS are most common in runners and jumpers who make training blunders, such as overloading or going too fast for their ability.

The middle portion of the medial tibia is a frequent site of pain. Conversely, MTSS can impact the leg's whole length (Brekke et al., 2025) Soreness on the lateral side is typically described as dull and uncomfortable. It usually starts at the beginning of an exercise and gets worse as it goes on. Pain increases with movement and decreases with rest (Linck et al., 2024). Posteromedial border soreness of the tibia has been shown to be the most sensitive area of MTSS (Alfayez et al., 2017).

Changes in the training routine, such as increased distance, intensity, and length, may also be associated to this ailment (Galbraith & Lavallee, 2009). Wearing improper running shoes and running on difficult or uneven terrain may have contributed to the incident. The most frequently reported intrinsic variables are biomechanical abnormalities such abnormalities of the foot's arch, excessive foot pronation, and unequal leg length (Winters, 2018).

A new instrument for increasing joint range of motion or easing discomfort is the floss band (FLOSS). They can be used for rehabilitation or injury prevention before or after sports (A et al., 2020)). Tissue flossing is becoming a more prominent therapy option ((Driller & Overmayer, 2016). Tissue flossing is the application of external pressure on or above a muscle or joints in terms of the extremities. The coiled band's pressure properly preserves arterial blood flow while reducing or obstructing distal venous outflow from the location (Jones MT, 2021). Recent research has focused on the possible applications of this technique for increasing muscle recovery after strength endurance training.

Published by Australian International Academic Centre PTY.LTD.

http://dx.doi.org/10.7575/aiac.ijkss.v.13n.2p.86

METHODS

Participants and Study Design

The participants were selected according to inclusion criteria such as age between 18-40 years, both gender, history of shin pain, activity induced pain that occurs during or after exercise and exclusion criteria such as any bone infection, tibial fracture, loss of sensation, severe anxiety, vascular disease, cardiac disorders, skin allergy. Outcome measures such as Numeric Pain Rating Scale (NPRS), Lower Extremity Function Scale (LEFS), and MTSS-Score was opted in this study. All the measurements were assessed on the 1st day and after 5 weeks.

Randomization

The sample size determined using "G*power software, version 3.1.9.7. This was for a study involving two different groups, two measurements (pre- and post-intervention), with α level: 0.05 and a power (1-ß error): 0.80. A medium effect size (Cohen's d): 0.5 for t-test for two independent means.104 were contacted on the basis of eligibility criteria. 60 participants were selected and allocated in two groups; group-1 and group-2. All participants were allocated randomly in two groups following blind folded sealed envelope method. Both groups have 30 subjects in each. Consent was obtained before the study began. Group-1 was having stretching and icing treatment along with tissue flossing and foam rolling and group-2 was having only stretching and ice massage as treatment in Figure 1.

Outcome Measures

Numeric pain rating scale

In the NPRS, a segmented numerical version of the VAS, the respondent selects a whole number (0–10 integers) that most accurately reflects the intensity of their discomfort. From "0," which denotes no pain, to "10," which denotes the other extreme of pain ("worst pain imaginable"), the 11-point numerical scale (Kalpana et al., 2021).

Lower extremity functional scale

The Lower extremity functional scale (LEFS) is a reliable patient-rated outcome measure (PROM) for assessing lower extremity function. The Lower Extremity Functional Scale (LEFS) is designed to assess "patients' initial function, continuous improvement, and outcome" for a variety of lower-extremity conditions. The LEFS is a self-administered questionnaire. Patients respond to the question in relation to twenty various daily tasks (Bednarek et al., 2022).

Medial tibial stress syndrome score

The MTSS score specifically measures pain along the shin and limitation due to shin pain. MTSS score is a novel patients-rated shin splint outcome metric. The MTSS score consists of 15 items: current sporting activities, current amount of sporting activities, current content of sporting activities, pain while performing sporting activities, time to onset of pain during sporting activities, pain throughout sporting activities, pain throughout sporting activities, pain afer sporting activities, pain while standing, pain while walking, pain while walking up or down stairs, pain while performing common daily activities, pain at rest, pain at night and pain to touch (Padhiar et al., 2021).

Intervention

Tissue flossing

Patient assessment was done for pain and disability on first day. Patient is in supine/long sitting and comfortable position

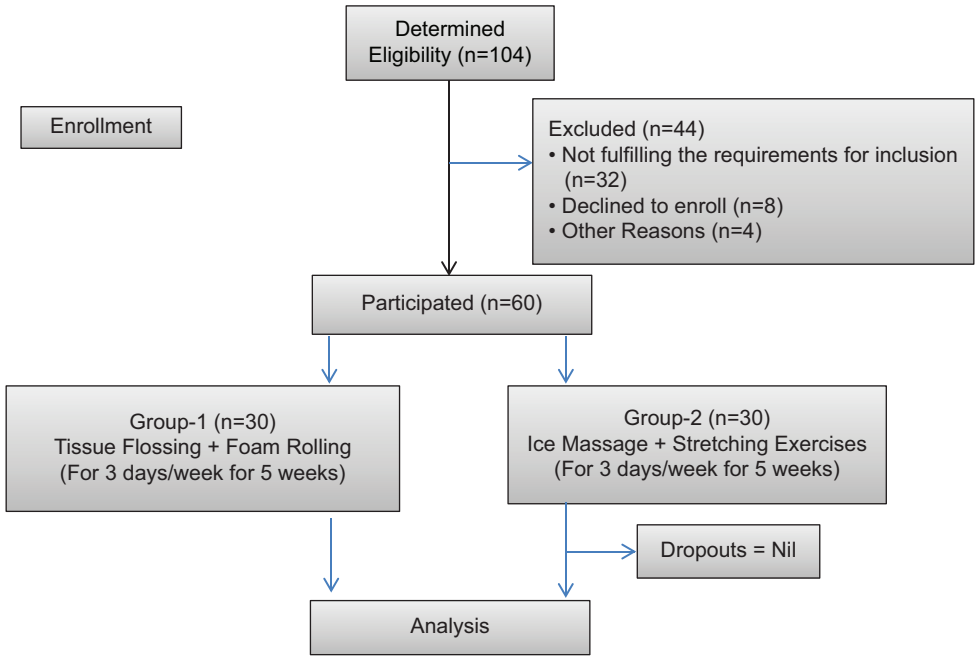

Figure 1. Flow chart of methodology adopted in this study

Figure 2. Application of tissue flossing on tibia

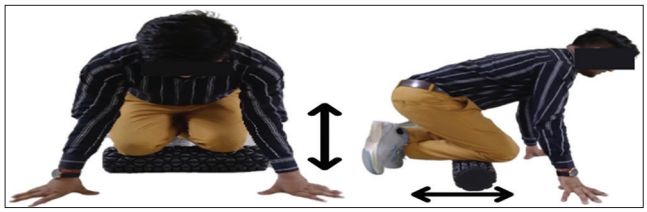

Figure 3. Application of foam rolling on tibia

in Figure 2. Ask patient to bend the knee of treatment leg for wrapping the floss band comfortably. Band wrapped around the leg. Wrapping should be done with a tension of 30–60% (James et al., 2007). The researcher wrapped the Shin distally to proximally with 50 percent overlap of the preceding segment of the band after stretching the band to 1.5 times its normal length with constant tension. The physiotherapist then did four rounds of passive twisting of the wrapped area of the leg, and the participant completed 20 times of active resisted ankle dorsiflexion and plantar flexion (Ravin et al., 2008). Remove band and repeat exercises without the band. Take 2 minutes of break before starting the next set. Complete this exercise for three sets. Treatment was given for 3 days (alternate days) in a week for 5 weeks. Patient re-assessment was done after 5th week treatment.

Foam rolling

Patient is over the foam roller in Figure 3. The patient was positioned with his hands supporting him and keeping his torso off the ground, with his non-affected leg crossed above his afflicted leg. By supporting some of their body weight with their hands, the participant should roll the foam roller distally and proximally from just distal to the knee to just proximal to the ankle. Complete two sets of 30 repetitions, three sessions per week for five weeks (Logan et al., 2006).

RESULTS

R software was used for all of the data analysis. NPRS, LEFS, and MTSS scores were analyzed before and after the outcome measure. At the start of the study, baseline data (pre-treatment value) was collected, and a t-test was used to examine the differences between the two groups after the treatment was completed (post-treatment value).

Comparison among the Groups

Changes in NPRS score in the group-1 (3.8 ± 1.2) was noticed as compared to the group-2 (4.5 ± 1.0) inTab. 2. Independent t-test showed a significantly greater improvement in LEFS in the group-1 (69.2 ± 5.7) compared to the group-2 (66.4± 5.6) in Tab. 2. The results indicate a statistically significant difference between groups for mean change in MTSS scores. Independent t-test showed a significant improvement in MTSS score in the group-1 (2.8± 1.5) compared to the group-2 (3.9 ± 1.4) as shown in Table 1.

Table 1. Independent t-test for baseline data of Numeric Pain Rating Scale, Lower Extremity Functional Scale and Medial Tibial Stress Syndrome score (after 5th week)

Measured Outcome Measures	Group-1 Mean±S.D	Group-2 Mean±S.D	t-value	p-value
NPRS	3.8±1.2	4.5±1.0	-4.569	0.002*
LEFS	69.2±5.7	66.4±5.6	4.406	0.004*
MTSSS	2.8±1.5	3.9±1.4	-7.045	0.000*

*$p < 0.05$

Table 2. Independent t-test for baseline data of Numeric Pain Rating Scale, Lower Extremity Functional Scale and Medial Tibial Stress Syndrome score (at 1st day)

Measured Outcome Measures	Group-1 Mean±S.D	Group-2 Mean±S.D	t-value	p-value
NPRS	6.1±1.0	5.7±0.8	3.556	0.756
LEFS	53.8±5.7	56.7±3.5	-4.539	0.291
MTSSS	5.2±0.8	5.5±0.5	-2.319	0.249

For each of the three factors, there were notable variations between groups 1 and 2. Thus, group 1 was the most effective in helping athletes with medial tibial stress syndrome improve their NPRS, LEFS, and MTSS scores. The results also suggest that Compared to group 2, tissue flossing combined with foam rolling was successful in enhancing function, reducing discomfort, and reducing tibial stress. MTSS was more significantly improved as compared to the NPRS and LEFS score as shown in Table 1 at 0.05 (p-value) level of significance.

DISCUSSION

This study sought to ascertain how tissue flossing with a foam roller affected the way patients with MTSS managed their pain and function. The study reveals that tissue flossing and foam roller delivered adjunct with ice and stretching effectively reduce the pain and improve the LEFS score. The difference was seen in all variables scores after five weeks of treatment. Our study's results are supported by a prior investigation that compared tissue flossing and conventional blood flow restriction in terms of making muscles tired. The result showed that tissue flossing promotes intramuscular metabolites accumulation through local stress on muscle during exercises (Jones et al., 2021). Foam roller-based myofacial release also induces asymptomatic release response that promotes pain relief that may be due to improvement in healing process through metabolic activation (Ferreira RM et al., 2022). It is possible that group-1 improved scores on

Table 3. Pre and post mean and mean difference of Numeric Pain Rating Scale, Lower Extremity Functional Scale and Medial Tibial Stress Syndrome score

Groups	Outcome Measures	Pre-test Mean±S.D	Post-test Mean±S.D	Mean Difference	*t*-value	*p*-value
	NPRS	6.1±1.0	3.8±1.2	2.3±0.08	17.202	0.000*
Group-1	LEFS	53.8±5.7	69.2±5.7	15.4±0.0	-20.446	0.000*
	MTSSS	5.2±0.8	2.8±1.5	2.4±0.7	23.028	0.000*
	NPRS	5.7±0.8	4.5±1.0	1.2±0.2	5.832	0.003*
Group-2	LEFS	56.7±3.5	66.4±5.6	9.7±2.1	-8.412	0.006*
	MTSSS	5.5±0.5	3.9±1.4	1.6±0.9	6.885	0.000*

*$p < 0.05$

outcome measures were caused by vascular occlusion using band flossing, which increased blood flow to muscle tissue and ultimately reduced tibial pain while also improving prevention or rehabilitation. However, previous studies have limited variables which are introduced by our study.

For patients with MTSS, physical therapy has also been adopted through heel cord stretching and calf muscle strengthening activities. Stretching exercise applied in MTSS improves the soft tissue extensibility and reduces the mechanical stress over the tibia (Ward, 2015). In addition, the reduction in mechanical stress improves the functions of lower extremities (Mattock et al., 2021). Pain reduction occurs at the postero-medial aspect of tibia with sympathetic-excitatory response through direct application of ice massage with stretching exercises (Stubbs et al., 2013). The findings of group-2 in our study are confirmed with (Herning, 2006) that regular protocol of stretching exercises of gastrocnemius muscle may be beneficial to prevent muscle fatigue.

Strengthening exercises are also delivered for controlling the foot deviation during running (Wilder & Sethi, 2004). It has been suggested that inadequate ground reaction force attenuation while running is one of the mechanisms causing decreased lower leg muscle size and endurance that contribute to MTSS symptoms (Mattock et al., 2018). The amount of lean muscle mass supporting the leg would eventually influences its ability to adjust favorably to loading pressure and sustain damage (Dishman et al., 2006). Strengthening exercises may also improve the muscle mass, reduces the pain through inhibition of mechanical stress on tibia and improve the muscle endurance that may restricts the recurrent episodes of MTSS (Warden SJ et al, 2021).

We have conducted an experimental study to see the effects of the tissue flossing technique and foam rolling to reduce pain and disability in MTSS. Total 60 patients were equally allocated in two groups. The NPRS, LEFS, and MTSS score was used as outcome measures. The total duration was 5 weeks while pre- and post-measurement took the first day and end of the fifth week respectively. In between the two group's pre and post values were assessed by independent t-test table 2 and table 1 at 1st day and after 5th week respectively. The findings show that the tissue flossing and foam rolling techniques resulted in more improvement in pain and disability and improvement in function than the application of stretching and ice massage. Table 3 compares the means and mean differences of the two groups. This is the first pre and post experimental design study that compares two treatment approaches among the athlete with MTSS.

According to the study's findings, foam rolling and tissue flossing work well together as an intervention for MTSS. This method may aid in tissue healing, increase flexibility, and lessen muscular tension, as seen by the notable decreases in pain and enhancements in functional mobility. The experimental group's quicker recovery period emphasizes the possible advantages of using these methods in a rehabilitation program. To validate these results and prove long-term advantages, more research is necessary with bigger sample numbers and longer follow-up times. Some limitations apply to the study. The sample size was small. Only one sports stadium and institute served as the site for data collection for the study. The goal of future studies should be to increase the effectiveness of tissue flossing using foam rolling.

Pre and Post-treatment mean Differences Comparison

Mean difference in NPRS score in group-1 was (2.3±.08) as compared to the group-2 (1.2±0.2). The mean differences of LEFS score in group-1was (15.4±0.0) as compared to the group-2 (9.7±2.1). The difference of MTSS score in group-1 was (2.4±0.7) as compared to group-2 (1.6±0.9). There was no significant improvement found in LEFS score as compared to the NPRS and MTSS score in both groups.

CONCLUSION

Both techniques we used are effective in reducing pain in MTSS but the When comparing the mean differences in NPRS, LEFS, and MTSS scores at the first and fifth weeks, group-1 performed better than group-2. Despite the notable disparity in the two groups' results, tissue flossing combined with foam rolling is a useful method for lessening the severity of MTSS.

Ethical Approval

Ethical approval was obtained Ref No: - SMC/UECM/2022/390/200 from the University Ethical Committee (Medical), Swami Vivekanand Subharti University, Meerut, Uttar Pradesh, India.

Acknowledgement

We would like to express our sincere gratitude to all participants who participated in this research work. We would like to thank library of Galgotias University for providing the online research platform for collecting the data. Special thanks to Swami Vivekanand Subharti University for providing the necessary resources for this research work.

Author Contribution

The Conceptualization, methodology, software check, investigation, resources, data curation, writing - rough preparation was done by DC, PB, YB, BP & AS writing - review and editing was done by SR, AS, and VNK supervision was done by SA, project administration, and formal analysis was done by AS, BP, YB & SR. All authors have read and agreed with the published version of the manuscript.

REFERENCES

Jasty, N. M., Dyrek, P., Kaur, J., Ackerman, K. E., Kraus, E., & Heyworth, B. E. (2021). Evidence-Based Treatment and Outcomes of tibial bone stress Injuries. Journal of the Pediatric Orthopaedic Society of North America, 3(4), 372. https://doi.org/10.55275/jposna-2021-372

Deshmukh, N. S., & Phansopkar, P. (2022). Medial Tibial Stress Syndrome: A review article. Cureus. https://doi.org/10.7759/cureus.26641

Yagi, S., Muneta, T., & Sekiya, I. (2012). Incidence and risk factors for medial tibial stress syndrome and tibial stress fracture in high school runners. Knee Surgery Sports Traumatology Arthroscopy, 21(3), 556–563. https://doi.org/10.1007/s00167-012-2160-x

Brekke, A. F., Bjørklund, J., Holse, R. C., Larsen, C., & Hjortshoej, M. H. (2025). Low-Load Blood-flow Restriction Training for Medial Tibial Stress-Syndrome in Athletes: A case series. International Journal of Sports Physical Therapy, 20(1). https://doi.org/10.26603/001c.126963

Linck, G., & Boissonnault, B. (2024). Symptom Investigation: Screening for Medical Conditions. In Foundations of Orthopedic Physical Therapy (pp. 80-104). Routledge. https://doi.org/10.4324/9781003524212

Alfayez, S. M., Ahmed, M. L., & Alomar, A. Z. (2017). A review article of medial tibial stress syndrome. Journal of Musculoskeletal Surgery and Research, 1(1), 2. https://doi.org/10.4103/jmsr.jmsr_13_17

Galbraith, R. M., & Lavallee, M. E. (2009). Medial tibial stress syndrome: conservative treatment options. Current Reviews in Musculoskeletal Medicine, 2(3), 127–133. https://doi.org/10.1007/s12178-009-9055-6

Winters, M. (2018). Medial tibial stress syndrome: diagnosis, treatment and outcome assessment (PhD Academy Award). British Journal of Sports Medicine, 52(18), 1213–1214. https://doi.org/10.1136/bjsports-2017-098907

A, G. M., M, C. J., Julián, G., & Miguel, G. (2020). The effects of tissue flossing on perceived knee pain and jump performance: a pilot study. International Journal of Human Movement and Sports Sciences, 8(2), 63–68. https://doi.org/10.13189/saj.2020.080203

Driller, M. W., & Overmayer, R. G. (2016). The effects of tissue flossing on ankle range of motion and jump performance. Physical Therapy in Sport, 25, 20–24. https://doi.org/10.1016/j.ptsp.2016.12.004

Kalpana, Muniyan, M. K., & Suresh, A. M. R. (2021). Effect of Agility and Perturbation Training on Pain, Balance and Functional Ability in Subjects with Patellofemoral Pain Syndrome. International Journal of Health Sciences and Research, 11(7), 204–226. https://doi.org/10.52403/ijhsr.20210730

Bednarek, M., Belka, M., Koziej, M., Brudnicki, J., Gądek,A., Bigaj, M., & Trybus, M. (2022). Validation of the Polish versions of the Lower Limb Task Questionnaire, Lower Limb Functional Index, and Lower Limb Functional Index-10. Journal of Orthopaedic Science, 28(6), 1345–1352. https://doi.org/10.1016/j.jos.2022.09.009

Padhiar, N., Curtin, M., Aweid, O., Aweid, B., Morrissey, D., Chan, O., Malliaras, P., & Crisp, T. (2021). The effectiveness of PROLOTHERAPY for recalcitrant Medial TIBIAL Stress Syndrome: a prospective consecutive CASE series. Journal of Foot and Ankle Research, 14(1). https://doi.org/10.1186/s13047-021-00453-z

James, S. L. J., Ali, K., Pocock, C., Robertson, C., Walter, J., Bell, J., & Connell, D. (2007). Ultrasound guided dry needling and autologous blood injection for patellar tendinosis. British Journal of Sports Medicine, 41(8), 518–521. https://doi.org/10.1136/bjsm.2006.034686

Ravin T, Cantieri M, Pasquarello G (2008). Principles of prolotherapy, vol. 233. Denver, CO: American Academy of Musculoskeletal Medicine; 250–1.

Logan C (2006). The scoop on running injuries: help runners to avoid common injuries--and to cope with them when they do occur. IDEA Fitness Journal. Nov 1;3(10):39-42.

Jones MT (2021). A Comparison of Traditional Blood Flow Restriction Versus Band Tissue Flossing for Induction of Muscular Fatigue. The University of Alabama.

Ferreira RM, Martins PN, Goncalves RS (2022). Effects of Self-myofascial Release Instruments on Performance and Recovery: An Umbrella Review. International Journal of Exercise Science, 15(3):861-883.https://doi.org/10.70252/GOXI7904

Ward, K. (2015). Routledge Handbook of Sports Therapy, Injury Assessment and Rehabilitation. In Routledge eBooks. https://doi.org/10.4324/9780203807194

Mattock, J., Steele, J. R., & Mickle, K. J. (2021). Lower leg muscle structure and function are altered in long-distance runners with medial tibial stress syndrome: a case control study. Journal of Foot and Ankle Research, 14(1). https://doi.org/10.1186/s13047-021-00485-5

Stubbs N, Menke E, Back W, Clayton HM (2013). Rehabilitation of the locomotor apparatus. Equine locomotion. 2nd edition. London: Elsevier. Jun 6:381-417. ISBN: 9780702058530

Herring, K. M. (2006). A Plyometric Training Model Used to Augment Rehabilitation from Tibial Fasciitis. Current

Sports Medicine Reports, 5(3), 147–154. https://doi.org/10.1097/01.csmr.0000306305.33567.22

Wilder, R. P., & Sethi, S. (2004). Overuse injuries: tendinopathies, stress fractures, compartment syndrome, and shin splints. Clinics in Sports Medicine, 23(1), 55–81. https://doi.org/10.1016/s0278-5919(03)00085-1

Mattock, J., Steele, J. R., & Mickle, K. J. (2018). A protocol to prospectively assess risk factors for medial tibial stress syndrome in distance runners. BMC Sports Science Medicine and Rehabilitation, 10(1). https://doi.org/10.1186/s13102-018-0109-1

Dishman, R. K., Berthoud, H., Booth, F. W., Cotman, C. W., Edgerton, V. R., Fleshner, M. R., Gandevia, S. C., Gomez-Pinilla, F., Greenwood, B. N., Hillman, C. H., Kramer, A. F., Levin, B. E., Moran, T. H., Russo-Neustadt, A. A., Salamone, J. D., Van Hoomissen, J. D., Wade, C. E., York, D. A., & Zigmond, M. J. (2006). Neurobiology of exercise. Obesity, 14(3), 345–356. https://doi.org/10.1038/oby.2006.46

Warden, S. J., Edwards, W. B., & Willy, R. W. (2021). Optimal Load for Managing Low-Risk Tibial and Metatarsal Bone stress injuries in runners: The Science Behind the Clinical Reasoning. Journal of Orthopaedic and Sports Physical Therapy, 51(7), 322–330. https://doi.org/10.2519/jospt.2021.9982