Appendix 1 Studies included in the systematic review and the risk factors measured within the studies

Author(s)	Title	Journal	Risk Factors
Bandholm T, Boysen L, Haugaard S, Zebis MK, Bencke J	Foot medial longitudinal-arch deformation during quiet standing and gait in subjects with medial tibial stress syndrome	*J Foot Ankle Surg* 2008;47:89-95	Navicular drop difference (mm) Navicular height loaded (mm) Navicular height neutral (mm) Medial longitudinal arch deformation difference (deg) Medial longitudinal arch deformation difference during walking (deg) Medial longitudinal arch angle heel strike (deg) Medial longitudinal arch angle loaded (deg) Medial longitudinal arch angle neutral (deg) Medial longitudinal arch angle push-off (deg)
Bennett JE, Reinking MF, Pluemer B, Pentel A, Seaton M, Killian C	Factors contributing to the development of medial tibial stress syndrome in high school runners	*J Orthop Sports Phys Ther* 2001;31:504-10	Active DF (deg) Navicular drop (mm) Rearfoot angle (deg) Resting calcaneal position in stance (deg) Sex (m,f) Tibiofibular varum (deg)
Delacerda FG	A study of anatomical factors involved in shinsplints	*J Orthop Sports Phys Ther* 1980;2:55-9	Footprint angle (deg) Navicular bone position (navicular drop) (mm) Weight:height ratio (kg/cm)
Franklyn M, Oakes B, Field B, Wells P, Morgan D	Section modulus is the optimum geometric predictor for stress fractures and medial tibial stress syndrome in both male and female athletes	*Am J Sports Med* 2008;36:1179-89	Tibia Measures: Anteroposterior dimension of the medullary region (mm) Anteroposterior width (mm) Amount of elongation (mm^4) Cross-sectional area (mm^2) Distal width (mm) Lateral length (mm) Maximum second moment of area (mm^4) Medial length (mm) Minimum second moment of area (mm^4) Mediolateral width (mm) Mediolateral dimension of the medullary region (mm) Polar moment of area (mm^4) Proximal width (mm) Radius of gyration Section modulus
Gehlsen GM, Seger A	Selected measures of angular displacement,	*Res Q Exerc Sport* 1980;51:478-85	Angular displacement (calcaneus and midline of lower leg (LL) (deg) - slow speed, shoes, contact Angular displacement (deg) - slow speed, shoes, support

	strength, and flexibility in subjects with and without shin splints	Angular displacement (deg) - fast speed, no shoes, contact Angular displacement (deg) - fast speed, no shoes, support Angular displacement (deg) - fast speed, no shoes, takeoff Angular displacement (deg) - slow speed, shoes, takeoff Angular displacement (deg) - fast speed, shoes, contact Angular displacement (deg) - fast speed, shoes, support Angular displacement (deg) - fast speed, shoes, takeoff Angular displacement (deg) - slow speed, no shoes, contact Angular displacement (deg) - slow speed, no shoes, support Angular displacement (deg) - slow speed, no shoes, takeoff DF ROM (deg) DF strength (lb) EV ROM (deg) EV strength (lb) Height (cm) INV ROM (deg) INV strength (lb) Leg length (cm) PF ROM)(deg) PF strength (lb) Weight (kg)
Hubbard TJ, Carpenter EM, Cordova ML	Contributing factors to medial tibial stress syndrome: a prospective investigation	Age (yrs) DF ROM (deg) EV ROM (deg) Females only: age of menstruation (yrs) Females only: have a regular menstrual cycle (yes/no) Females only: take birth control (yes/no)Height (cm) How long subject has been running (yrs) How often change running shoes (per year) INV ROM (deg) Isometric PF (N-kg $^{-1}$) Isometric DF (N-kg $^{-1}$) Isometric INV (N-kg $^{-1}$) Isometric EV (N-kg $^{-1}$) Miles run / week (miles) Navicular drop (mm) PF ROM (deg) Previous history of MTSS (yes/no) Previous history of stress fracture (yes/no) Take vitamins (yes/no) Tibial varum (deg) Wear orthotics (yes/no) Weight (kg)

Lilletvedt J, Kreighbaum E, Phillips RL	Analysis of selected alignment of the lower extremity related to the shin splint syndrome	*J Am Podiatry Assoc* 1979;69:211-7	Calcaneus position in relationship to the floor - subtalar joint neutral (deg) Calcaneus position in relationship to the floor - subtalar joint static (deg) DF ROM - knee extended (deg) DF ROM - knee flexed (deg) ER hip ROM - hip flexed (deg) ER hip ROM - hip ext (deg) EV ROM (deg) Forefoot position in relationship to rearfoot (deg) Frontal plane position of tibia - subtalar joint neutral (deg) Frontal plane position of tibia - subtalar joint static (deg) Hamstring flexibility (deg) INV ROM (deg) IR hip ROM - hip ext (deg) IR hip ROM - hip flex (deg) Transverse plane position of malleoli (deg)
Madeley LT, Munteanu SE, Bonanno DR	Endurance of the ankle joint plantar flexor muscles in athletes with medial tibial stress syndrome: a case-control study	*J Sci Med Sport* 2007;10:356-62	BMI (kg/m^2) Height (m) Standing heel raise (#)
Messier SP, Pittala KA	Etiologic factors associated with selected running injuries	*Med Sci Sports Exerc* 1988;20:501-5	Apparent leg length difference (%>0.64 cm) DF ROM (deg) Foot print Hamstring flexibility (% abnormal) Lowerleg flexibility (% abnormal) Max pronation (deg) Max pronation velocity (deg/s) PF ROM (deg) Q-angle (deg) Running terrain (% hills, crowned roads, trails) Sit and reach (cm) Time to max pronation (ms) Total rearfoot movement (deg) True leg length difference (not reported)
Moen MH, Bongers T, Bakker EW, Zimmermann AW, Tol JL, Backs FJG	Risk factors and prognostic indicators for medial tibial stress syndrome	*Scand J Med Sci Sports* 2012;22:34-9	Ankle DF (deg) Ankle PF (deg) BMI (kg/m^2) Duration of complaints (days) Hallux flex (deg) Hallux ext (deg)

			Height (cm) Hip ER ROM (deg) Hip IR ROM (deg) Knee extension (deg) Knee flexion (deg) Lean calf girth (cm) Max calf girth (cm) Navicular drop >0.5cm (yes/no) Pre-rehab symptom free running distance (m) Sports Rated Activity Scale at baseline (0-100) Standing foot angle <140deg (yes/no) Subtalar EV (deg) Subtalar INV (deg)
Newman P, Adams R, Wassington G	Two simple clinical tests for predicting onset of MTSS: shin palpation test and shin oedema test	*Br J Sports Med* 2012;46:861-4	Area under the curve - shin palpation test Area under the curve - shin palpation test + shin oedema test Area under the curve - shin palpation test + shin oedema test + female Shin oedema test (yes,no) Shin pain and oedema test (yes,no) Shin palpation test (yes,no)
Plisky MS, Rauh MJ, Heiderscheit B, Underwood FB, Tank RT	Medial tibial stress syndrome in high school cross-country runners: incidence and risk factors	*J Orthop Sports Phys Ther* 2007;37:40-7	BMI (Q1 - low </= 18.7 kg/m^2, Q2 - 18.8-20.1 kg/m^2, Q3 - 20.2-21.6 kg/m^2, Q4 - high >21.7 kg/m^2) Grade (9^{th}, 10^{th}, 11^{th}, 12^{th}) Left to right difference in navicular drop (0-3 mm, > 3mm) Navicular drop (</=10mm, >10mm) Orthotic use (yes/no) Previous injury (0, 1+) Running experience (0-3 y, 4+ y) Sex (m,f)
Raissi GR, Cherati AD, Mansoori KD, Razi MD	The relationship between lower extremity alignment and medial tibial stress syndrome among non-professional athletes	*Sports Med Arthrosc Rehabil Ther Technol* 2009;1:11	Achilles angle (deg) Anterior location of previous pain (%) BMI (kg/m^2) Duration of MTSS (hours) Duration of professional activity (unit not reported) Height (m) Intercondylar distance of femur (mm) Intermaleolar distance (mm) Length of weekly physical activity (%) Navicular drop (mm) Positive history of professional activity (%) Past history of pain (%) Q-angle (deg) Tibia angle (deg)

Rathleff MS, Kelly LA, Christensen FB, Simonsen OH, Kaalund S, Laessoe U	Dynamic midfoot kinematics in subjects with medial tibial stress syndrome	*J Am Podiatr Med Assoc* 2012;102:205-12	Dynamic navicular drop (mm) FPI-6 Preferred walking speed (km/h) Static navicular drop (mm) Velocity of dynamic navicular drop (mm/sec) Visual analog scale (VAS) – during activity (cm) Visual analog scale – pain at rest (cm)
Rauh MJ, Macera CA, Trone DW, Reis JP, Shaffer RA	Selected static anatomic measures predict overuse injuries in female recruits	*Milit Med* 2010;175:329-35	Ankle DF ROM (</= 10, 11-20, >/= 21 deg) Ankle EV ROM (0-1, 2-10 >/= 11 deg) Arch index (low: (</=0.149, normal: 0.150-0.216, >/=0.217) Hip IR ROM (</=25, 26-45, >/= 46) Knee alignment (varus, valgus, valgus/varus) Knee hyperextension (</= 5, >/= 6 deg) Leg length difference (</=0.5, >0.5-1.0, >1.0-1.5, >1.5 cm) Ober's Test (positive, negative) Pelvic Width/Femur Length Ratio (narrow: </= 0.26, normal: 0.27-0.30, wide: >/= 0.31) Q-angle (< 20, >/= 20 deg)
Sharma J, Golby J, Greeves J, Spears IR	Biomechanical and lifestyle risk factors for medial tibia stress syndrome in army recruits: a prospective study	*Gait Posture* 2011;33:361-5	Biomechanics (good, poor) Fitness (good, poor) Smoking (yes, no)
Sommer HM, Vallentyne SW	Effect of foot posture on the incidence of medial tibial stress syndrome	*Med Sci Sports Exerc* 1995;27:800-4	Standing foot angle (deg) Varus position (forefoot and hindfoot varus, forefoot or hindfoot varus, no varus)
Tweed JL, Campbell JA, Avil SJ	Biomechanical risk factors in the development of medial tibial stress syndrome in distance runners	*J AM Podiatr Med Assoc* 2008;98:436-44	1st metatarsophalangeal DF (unit not reported) Abductory twist (yes/no) Ankle DF ROM – knee ext (unit not reported) Ankle DF ROM – knee flex (unit not reported) Apropulsive gait (yes/no) Early heel lift (yes/no) FPI (unit not reported) Pronation (PRO) at early stance (yes/no) PRO at heel strike (yes/no) PRO late stance (yes/no) PRO at mid-stance (yes/no) PRO at propulsion (yes/no) Relaxed calcaneal stance (unit not reported)

			Relaxed to neutral calcaneal stance position difference (unit not reported)
Viitasalo JT, Kvist M	Some biomechanical aspects of the foot and ankle in athletes with and without shin splints	*Am J Sports Med* 1983;11:125-30	Achilles angle, treadmill running – before touch down, during full support during full support – minimum, during full support –maximum, after heel takeoff, at the ball of the foot takeoff Angular displacement, treadmill runnning – before touch down-during full support, during full support min-during full support max, during full support-after heel takeoff, after heel takeoff-at the ball of the foot takeoff Passive subtalar EV (deg) Passive subtalar INV (deg) Passive subtalar sum (deg) Standing feet diagonal – leg angle, calcaneus angle, achilles angle (deg) Standing normal – leg angle, calcaneus angle, achilles angle (deg) Standing heels together – leg angle, calcaneus angle, achilles angle (deg)
Yagi S, Muneta T, Sekiya I	Incidence and risk factors for medial tibial stress syndrome and tibial stress fracture in HS runners	*Knee Surg Sports Traumatol Arthrosc* 2013;21:556-63	BMI (kg/m^2) Height (cm) Hip ABD strength (N) Hip ER ROM (deg) Hip IR ROM (deg) Intercondylar and intermalleolar interval (mm) Navicular drop (mm) Passive ankle DF – knee ext (deg) Passive ankle DF – knee flex (deg) Q-angle (deg) Straight leg raise (deg) Weight (kg)
Yates B , White S	The incidence and risk factors in the development of medial tibial stress syndrome among naval recruits	*Am J Sports Med* 2004;32:772-80	Ankle DF - knee ext (deg) Ankle DF - knee flex (deg) BMI (kg/m^2) FPI (-16-16) FPI (supinated, normal, pronated, highly pronated) Previous Hx of MTSS (yes, no) Sex (m,f) Weekly exercise (hrs) Weekly weightbearing exs (hrs) Weekly weightbearing exs excluding walking (hrs)

BMI: body mass index, DF: dorsiflexion, ER: external rotation, EV: eversion, f: female, FPI: foot posture index, INV: inversion, IR: internal rotation, m: male, Q-angle: quadriceps angle, ROM: range of motion