Table 1. Summary of Studies Included in the Narrative Review

#	Authors & Year	Sample Size	Methodology	Key Findings
1	Paul et al. (2023)	669 Studies	Systematic review	Female athletes significantly underrepresented in sports medicine research relative to males. Most studies isolated male athletes (70.7%), while 8.8% isolated female athletes and 20.5% included male and female athletes. Notably, male athletes were largely favored in baseball/softball (91% vs 5%; OR = 18.2), rugby (72% vs 5%; OR = 14.4), soccer (65% vs 15%; OR = 4.3), and basketball (58% vs 18%; OR = 3.2).
2	Meeuwisse et al. (2003)	318 athletes	Prospective cohort	Knee injuries most common for time-loss >7 sessions; ankle injuries most common for minor time-loss in Canadian intercollegiate basketball. Injuries occurred 3.7 times more often in games than during practice.
3	Vicentini et al. (2025)	Review	Narrative review / imaging	Ankle and knee injuries most common in basketball; injury rates substantially higher in games than practices. Overuse injuries are also frequent in basketball and may develop silently and progress over time.
4	Stojanovic et al. (2023)	Thirty studies (17 reporting ACL injuries and 16 reporting ankle sprains)	Systematic review & meta-analysis	Lower extremity injury rates greater at higher competition levels; ACL and ankle sprain incidence quantified across basketball populations. Higher ($p < 0.05$) ACL injury incidence rates per 1000 athlete-exposures were recorded in females (female: 0.20 95% confidence intervals [0.16-0.25]; male: 0.07 [0.05-0.08]; female-to-male ratio: 3.33 [3.10-3.57]), in players competing at higher playing levels (amateur: 0.06 [0.04-0.09]; intermediate: 0.16 [0.13-0.20]; elite: 0.25 [0.14-0.64]), and in games (games: female, 0.27 [0.21-0.32]; male, 0.06 [0.03-0.08]; training: female, 0.03 [0.02-0.05]; male: 0.01 [0.00-0.02]; game-to-training ratio: 7.90 [4.88-12.91]).
5	Zuckerman et al. (2016)	2308 injuries for men and 1631 injuries for women	Injury surveillance (NCAA) and meta-analysis	The rate was higher in men than women (RR=1.22; 95% CI 1.15 to 1.30). Non-time-loss (NTL) injuries (resulting in participation restriction time under 24 hours) accounted for 64.8% and 53.6% of men's competition and practice injuries, respectively, and 53.9% and 51.3% of women's competition and practice injuries, respectively. Injuries to the lower extremity were the most common in competitions (men: 54.9%; women: 59.0%) and practices (men: 62.4%; women: 67.3%). The most common injury in men's and women's basketball was ankle sprain (17.9% and 16.6%, respectively).
6	Lian et al. (2022)	1253 unique studies, final inclusion=49	Systematic review	The 5 most common orthopedic sports injuries sustained in the NBA were concussions (9.5-14.9 per year), fractures of the hand (3.5-5.5 per year), lower extremity stress fractures (4.8 per year), meniscal tears (2.3-3.3 per year), and anterior cruciate ligament tears (1.5-2.6 per year).
7	Taylor et al. (2015)	426 individual studies, final inclusion=9	Systematic review & meta-analysis	Prophylactic programs reduced the incidence of general lower extremity injuries (odds ratio [OR], 0.69; 95% CI, 0.57-0.85; $P < 0.001$) and ankle sprains (OR, 0.45; 95% CI, 0.29-0.69; $P < 0.001$), yet not ACL ruptures (OR, 1.09; 95% CI, 0.36-3.29; $P = 0.87$) in basketball athletes.
8	Milic et al. (2025)	480 Articles, final inclusion=212	Systematic review	Ankle most common injury across sports; female ACL incidence ratio 2.18 vs males; greater knee valgus in female athletes.
9	Aksovic et al. (2024)	492 Articles, final inclusion=64	Systematic review	ACL injuries: 22.1% (M) vs 45.9% (F) of knee injuries; females ~4x more likely to sustain ACL injury; 3D kinematic analysis showed greater knee valgus in females.

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10	McKeon & Hoch (2019)	ICF Model	Clinical review	Ankle sprain mechanism and anatomy; healing 1-12 weeks; chronic ankle instability and osteoarthritis as long-term sequelae.
11	Herzog et al. (2019)	Final inclusion articles=57	Epidemiological review	Ankle sprains highly recurrent; chronic ankle instability in ~40% of cases; epidemiology across multiple sports populations.
12	Schiftan et al. (2015)	3726 participants	Systematic review & meta-analysis	Proprioceptive training reduces ankle sprain risk; secondary prevention more effective than primary prevention strategies. Proprioceptive training compared to a range of control interventions (relative risk=0.65, 95% CI 0.55-0.77). Results with intervention remained significant for participants with a history of ankle sprain (relative risk=0.64, 95% CI 0.51-0.81). Results exclusively at primary prevention in those without a history were also statistically significant (relative risk=0.57, 95% CI 0.34 to 0.97)
13	Davis et al. (2021)	825 individual studies, final inclusion=13	Systematic review	Neuromuscular warm-up programs modestly but meaningfully reduce lower extremity injury risk in basketball for both sexes. However, most studies are underpowered, some used lower-quality research study designs, and outcome and exposure definitions varied.
14	Lopez-Valenciano et al. (2020)	44 studies	Systematic review & meta-analysis	The overall incidence of injuries in professional male football players was 8.1 injuries/1000 hours of exposure. Match injury incidence was almost 10 times higher than training injury incidence rate. Lower extremity injuries had the highest incidence rates (6.8 injuries/1000 hours of exposure). The most common types of injuries were muscle/tendon (4.6 injuries/1000 hours of exposure), which were frequently associated with traumatic incidents.
15	Giza & Micheli (2005)	Literature Review	Narrative review	Knee and ankle most common soccer injuries; incidence 8.55/1,000 practice hours to 14.8/1,000 game hours.
16	Biz et al. (2021)	1017 individual studies, final inclusion=8 HSIs recorded =165 in the intervention groups and =224 in the control groups.	Systematic review & meta-analysis	Hamstring strains leading injury in professional football (2.29/1,000 hrs); The meta-analysis of six of the eight included studies provided strong evidence that interventions are effective in reducing hamstring injuries. The IRR of the effect size was 0.443, with p-value = 0.001. Nordic hamstring exercise, the FIFA 11+ program and exercises for core stability or balance training have a successful effect on prevention of hamstring injuries. Nordic exercises reduce recurrence by 86%.
17	Mufty et al. (2015)	Nationwide cohort	Epidemiological study	Female soccer players had 24% lower overall injury rate (5.23 vs 6.83/100 players); females sustained more severe injuries ($p<0.0001$). Significantly more injuries where sustained during competition in both males and females.
18	Robles-Palazon et al. (2022)	43 studies	Systematic review & meta-analysis	The lower extremity had the highest incidence rate in both sexes. The most common type of injury was muscle/tendon for males (1.92/1,000 hrs) and joint/ligament for females (2.36/1,000 hrs).
19	Cross et al. (2013)	NCAA ISS from 2004 to 2009	Descriptive epidemiology study	Males 64% more likely than females to sustain hamstring injuries; males accounted for 59.5% of total strains. Identifying common characteristics may assist in the targeted development of preventive and rehabilitative programs as well as continued research on hamstring strains among collegiate soccer players.
20	Opar et al. (2012)	139 studies	Narrative review	Hamstring strains caused by eccentric overload during sprinting; prior injury and strength imbalance are key risk factors; high reinjury rate.

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21	Freckleton & Pizzari (2013)	1649 individual studies, final inclusion=8	Systematic review & meta-analysis	Previous hamstring injury is strongest predictor of recurrence; quad-hamstring strength imbalance associated with increased risk.
22	Hickey et al. (2022)	63 Studies	Narrative review	Return to sport typically within weeks; reinjury common; structured progressive loading recommended for rehabilitation. Eccentric hamstring exercises and hip-extensor strengthening should be implemented during rehabilitation.
23	Kjaer et al. (2025)	93 Research Papers	Narrative review	Chronic hamstring tendinopathy can be career-limiting; tendon overuse distinguished from acute muscle strain; loading exercise therapies by far surpass non-loading therapies or wait-and-see policy.
24	Al Attar & Husain (2023)	Total 2694 RCTs, final inclusion=5, 4728 players and 379,102 exposure hours	Systematic review and meta-analysis of RCTs	Core strengthening + Nordic exercises reduced hamstring injury recurrence by 86%; limited female-specific data available. The pooled results of 4728 players and 379,102 exposure hours showed 47% hamstring injury reduction per 1000 h of exposure in the intervention group compared with the control group with an injury risk ratio of 0.53 (95% CI [0.28, 0.98], P = 0.04).
25	Crossley et al. (2020)	11,773 female players	Systematic review & meta-analysis	In women's football, there is low level evidence that multicomponent, exercise-based programs reduce overall and ACL injuries by 27% and 45%, respectively.
26	Young et al. (2023)	27 studies	Narrative review	Lower extremity accounts for 50-60% of volleyball injuries; ankle most common; upper extremity 20-30%; patellar tendinopathy prominent.
27	Bere et al. (2015)	FIVB surveillance 32 major events (23 senior and 9 junior)	Injury surveillance & meta-analysis	The incidence of time-loss injuries during match play was 3.8/1000 player hours (95% CI 3.0 to 4.5); this was greater for senior players than for junior players (relative risk: 2.04, 1.29 to 3.21), while there was no difference between males and females (1.04, 0.70 to 1.55). Ankle injuries 25.9%, knee 15.2% of injuries in world-class volleyball; overall low injury risk at elite level.
28	de Azevedo et al. (2023)	3698 youth volleyball athletes predominantly females	Systematic review	Ankle injuries most prevalent in young volleyball players (31.52%); knee second (15.3%). Other most commonly affected region was upper limb (wrist, hand and fingers.)
29	Lee et al. (2024)	NEISS data 2013-2022	Descriptive epidemiology study	Top upper extremity volleyball injuries: finger (33.2%), shoulder (28.9%), wrist (16%); consistent across adult age groups. Adult populations are at risk for volleyball-related upper extremity injuries, specifically affecting the finger, wrist, and shoulder, younger adults more often sustained injuries from dynamic movements, whereas older adults sustained injuries from trauma.
30	Zech et al. (2022)	20 studies	Systematic review & meta-regression	For overall injuries, the pooled IRR = 0.86 (95% confidence interval (95%CI): 0.76−0.98) indicated significantly more injuries in male than in female players. For injury location, the pooled IRR showed higher injury rates in male athletes than in female athletes for upper extremity, hip/groin, thigh, and foot injuries.
31	Chandran et al. (2021)	NCAA women's volleyball	Injury surveillance (NCAA)	Knee and ankle injuries accounted for the largest proportion of all reported injuries, and most injuries were classified as sprains, strains, and

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		2014–2015 through 2018–2019 athletic years		inflammatory conditions; knee most prevalent (14.6%); ankle second (13.8%); shoulder 10.4% TL; noncontact and overuse injuries most common. Concussion was among the most prevalently reported injuries during the study period, and concussion incidence increased steadily during 2015-2016 through 2018-2019.
32	Haupenthal et al. (2023)	Brazilian national volleyball team, 48 athletes	Case study (prospective)	Knee (111/1,000 athletes) and ankle (69/1,000) most frequent injury sites in elite male volleyball. To manage risk of injuries for overload, specific injury prevention strategies are needed and should be included as an essential component of the training plan for elite volleyball players.
33	Kilic et al. (2017)	1722 individual studies, final inclusion=34	Systematic review	Men have higher ankle injury risk than women (RR 3.2) in volleyball; comprehensive etiology and prevention review. A risk factor for musculoskeletal injuries in volleyball often reported was gender (male vs. female); adult men have a higher risk for ankle injuries compared to adult women (RR of 3.2); statistically significant risk for patellar tendinopathy in adult men (OR of 2.6); statistically significant OR ranging from 2.89 to 4.03 was found for jumper's knee in adolescent men compared to adolescent women.
34	De Vries et al. (2014)	385 athletes (290 volleyball and 90 basketball players	Survey-based prospective cohort study	Patellar tendinopathy risk factors identified; OR 2.0 (95% CI 1.1-3.5) for males in general population. This was also found in the volleyball players separately (OR 2.6 95% CI 1.3–5.2). In the volleyball players a trend was found for increased odds for those jumping at work (OR 2.4 95% CI 1.0–5.5) compared to not jumping at work and for those performing heavy physically demanding work compared to mentally demanding work (OR 2.6 95% CI 0.9–7.8)
35	de Vries et al. (2015)	385 athletes (290 volleyball and 90 basketball players	Survey-based prospective cohort study (continuation of 2014)	No sports-related variables could be identified to increase the risk of developing PT, but some evidence was found for performing heavy physically demanding work, like being a nurse or a physical education teacher (OR 2.3, 95% CI 0.9–6.3). These findings indicate that, when considering preventive measures, it is important to take into account the total tendon load.
36	Baugh et al. (2018)	83 injuries in men and 510 injuries women	Descriptive Epidemiology Injury surveillance (NCAA)	Shoulder: 4.2% TL / 10.5% NTL (W); 6.5% TL / 19.6% NTL (M); hand/wrist higher in males for TL injuries. There are differences in injury patterns and rates between male and female intercollegiate volleyball players. Although a limited-contact sport, a notable number of concussions were sustained, mostly from ball contact.
37	Theodorou et al. (2023)	102 articles	Narrative review	Patellar tendinopathy predominantly noncontact; overuse and poor landing mechanics key causes; jumping sports at highest risk. Conservative treatment for PT consists of many methods, but the most popular are eccentric exercises
38	Gaitonde et al. (2019)	1,319 adults	Clinical review	Patellofemoral pain syndrome linked to weight-bearing activities; jumping substantially increases patellar joint stress. Women were more likely to develop the condition than men. Treatment should focus on early pain relief, relative rest, ice, and analgesics are recommended to reduce pain, but physical therapy is the cornerstone of treatment.
39	Cools et al. (2021)	72 articles	Narrative review	Shoulder internal rotation velocity reaches 7,000-7,500 deg/s in overhead sport; glenohumeral joint loading during spiking increases injury risk. In the rehabilitation, should consider exercises based on restoration of normal

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				muscle recruitment, implementation of the functional kinetic chain, and using external focus and controlled feedback.
40	Forthomme et al. (2013)	High-level volleyball players (34 men and 32 women)	Prospective observational	Shoulder rotator muscle strength evaluations through isokinetic assessment, especially eccentric mode, appeared the most contributing to identify risk factors for shoulder pain. Shoulder pain prevalent pre-season; strength imbalances, poor scapular control, and fatigue-related biomechanics implicated.
41	Cools et al. (2015)	67 articles	Narrative review	Posterior capsule stretching, posterior cuff strengthening, and scapular flexibility recommended for shoulder injury prevention in males.
42	Heming et al. (2025)	55 studies 33 228 athletes	Systematic review & meta-analysis	Very low-certainty evidence linking shoulder ROM/strength to injury in females; exercise programs reduced shoulder injury by 51% across sports. Strengthening and stability exercise programs may be beneficial to reduce shoulder injury rates in female athletes. Future research should prioritize female/woman/girl athletes to reduce the burden of injuries.
43	Scott & Nordin (2016)	31 articles	Narrative review	Limited evidence on dietary influence on tendon metabolism; collagen and micronutrients identified as relevant but understudied.
44	Hijlkema et al. (2022)	19 studies	Systematic review	Collagen supplementation improves tendinopathy; MSM, arginine, curcumin, boswellia, bromelain associated with reduced tendon pain.
45	DePhillipo et al. (2018)	286 individual articles, final inclusion=10	Systematic review	Vitamin C supports tendon, bone, and ligament healing in animal models and human participants; however limited human data warrants further research.
46	Lorincz et al. (2009)	105 articles	Narrative review	High-protein diets increase IGF-1 and bone mineral content; omega-3 linked to higher hip BMD; calcium, vitamin D, potassium essential for bone health.
47	Tabatabai & Sellmeyer (2021)	133 articles	Narrative review	Calcium, vitamin D, and other nutritional supplements support skeletal health; intake recommendations for active populations reviewed.
48	Swanson et al. (2018)	113 articles	Narrative review	Circadian rhythm disruption alters bone formation and metabolism; sleep disturbance linked to increased fracture risk.
49	Huang & Ihm (2021)	40 articles	Narrative review	<7 hrs sleep over >= 14 days associated with 1.7x greater musculoskeletal injury risk.
50	Grier et al. (2020)	7,576 US Army Special Operations Forces soldiers	Retrospective cohort	<4 hrs sleep associated with 2.35x musculoskeletal injury risk vs >=8 hrs; 95% male sample limits female generalizability.
51	Zhou et al. (2023)	289,000 participants	Prospective cohort observational & meta-analysis	Healthy sleep patterns associated with 17% reduction in falls and 28% reduction in fracture risk longitudinally.
52	Yang et al. (2024)	10,346 individuals	Cross-sectional population study	Short and long sleep duration both associated with low BMD; inactivity compounded risk; exercise mitigated sleep-related BMD loss.

Abbreviations: ACL = anterior cruciate ligament; BMD = bone mineral density; F = female; M = male; NTL = non-time-loss;

OR = odds ratio; RR = risk ratio; SOF = Special Operations Forces; TL = time-loss; ISS=Injury Surveillance System;

NCAA=National Collegiate Athletic Association; HIS=Hamstring strain injuries; Randomized Controlled Trials=RCTs; The International Volleyball Federation=FIVB.