Nutrition to aid Recovery from Musculotendinous Injuries

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Introduction

Musculotendinous (MT) injuries are frequently encountered in both athletic populations and everyday settings. These injuries can manifest with an acute onset, often resultant from trauma, or develop insidiously due to cumulative microtrauma related to overuse, frequently compounded by underlying biomechanical deficiencies or chronic illnesses. Effective recovery typically necessitates an initial period of rest, followed by a structured rehabilitation program and a phased, rational return to activity. However, the critical role of nutritional support in facilitating healing and recovery is often underemphasized and underutilized in clinical practice.

This article presents an evidence-based approach to implementing essential nutritional molecules that may enhance recovery outcomes for patients with musculotendinous injuries.

Muscle Injuries

Muscles are composed of bundles of muscle fibers, primarily organized into fascicles, which contain myofibrils made up of actin and myosin filaments. Actin and myosin filaments are fundamental protein components of the contractile apparatus in muscle fibers, facilitating muscle contraction through the sliding filament theory. When subjected to rapid or excessive stretching, or during abrupt movements involving eccentric contractions, the muscle fibers can become overstretched or overloaded, leading to injury.

Actin, a globular protein (G-actin), polymerizes to form filamentous actin (F-actin), which consists of a double helical structure. Each G-actin monomer, comprising approximately 375 amino acids—including key residues such as glycine, alanine, and serine—contains an ATP binding site. The polymerization process is regulated by actin-binding proteins that modulate filament dynamics, stability, and interactions with other proteins.

Myosin, predominantly in the form of myosin II in skeletal muscle, is a motor protein composed of two heavy chains and four light chains, leading to a structure characterized by a long tail and a globular head region. Each heavy chain has around 1,800 to 2,000 amino acids, incorporating residues like leucine, valine, and phenylalanine. The head region exhibits ATPase activity, allowing myosin to hydrolyze ATP, which provides the energy necessary for conformational changes that facilitate cross-bridge cycling with actin during contraction.

Protein deficiency can significantly delay muscle healing in various ways. Since both actin and myosin are proteins essential for muscle function and contraction, inadequate protein intake limits the availability of the necessary amino acids for the synthesis of these proteins. This can hinder muscle repair following injury by impairing the regeneration of muscle fibers and the formation of new contractile proteins. Specifically, protein deficiency can reduce the effectiveness of satellite cells—muscle progenitor cells that play a crucial role in muscle repair—leading to impaired repair processes.

Additionally, depletion of proteins necessary for collagen synthesis can weaken the extracellular matrix that supports muscle fibers and tendons, further compromising the integrity of the injured area. Moreover, inadequate protein intake delays the inflammatory response and subsequent reparative processes necessary for healing.

The intricate interactions between actin and myosin are further regulated by calcium ions, which bind to troponin and induce a conformational change that shifts tropomyosin and exposes myosin-binding sites on the actin filament. Dysregulation of this actin-myosin interaction due to insufficient protein levels can lead to various pathophysiological conditions, including muscle atrophy, cardiomyopathies, and skeletal muscle diseases, underscoring the critical roles of these proteins in muscle physiology and pathology.

Tendon Injuries

Tendons, which connect muscle to bone, are primarily composed of dense, parallel arrays of Type I collagen fibers, providing substantial tensile strength and resistance to mechanical loads. Type I collagen constitutes approximately 65-80% of the tendon's dry weight, with smaller contributions from Type III collagen, proteoglycans, glycoproteins, and elastin. These non-collagenous matrix components, although minor in proportion, play critical roles in the tendon's viscoelastic properties and its ability to endure repetitive stress. The primary cellular element within tendons is the tenocyte, a specialized fibroblast responsible for synthesizing and remodeling the extracellular matrix. Tenocytes are situated between collagen bundles and maintain tissue homeostasis through collagen turnover and response to mechanical stimuli.

Collagen, the primary structural protein in tendons, is synthesized through a highly regulated process involving both intracellular and extracellular stages. The formation of collagen begins with the transcription and translation of pro-collagen, a precursor molecule, in the endoplasmic reticulum of tenocytes. Pro-collagen consists of three polypeptide chains—two alpha-1 chains and one alpha-2 chain—that form a triple-helix structure. These chains undergo extensive post-translational modifications, including hydroxylation of specific proline and lysine residues, which are essential for stabilizing the triple-helix. Once secreted into the extracellular matrix, pro-collagen is cleaved by specific enzymes to produce mature collagen molecules. These molecules then spontaneously self-assemble into fibrils, which are further organized into collagen fibers. The hierarchical organization of these fibers provides tendons with their unique mechanical properties, including tensile strength and resistance to stretching.

Tendon pathologies typically manifest as tendinitis or tendinosis. Tendinitis denotes an acute inflammatory process, generally provoked by excessive mechanical loading or microtrauma without sufficient recovery, clinically presenting with localized pain, edema, and impaired function. In contrast, tendinosis is a chronic, degenerative condition characterized by the disruption and disorganization of collagen fibers, increased matrix metalloproteinase activity, and an overall decline in tensile strength. Histopathologically, tendinosis is marked by fibroblast proliferation, neovascularization, and increased deposition of non-collagenous matrix, rather than the inflammatory cell infiltration seen in tendinitis. The resulting tissue is functionally compromised, contributing to persistent pain and reduced biomechanical efficiency.

Stages of Healing in Musculotendinous Tissues Following Injury

The healing phases of muscle and tendon injuries share common elements but also have significant differences due to the distinct structural and functional properties of each tissue. Both tissues undergo the same overarching phases—inflammation, proliferation, and remodeling—but the specifics of each phase differ in terms of duration, cellular activity, and final outcomes, as well as the cytokines and growth factors involved.

1. Inflammatory Phase:

In both muscle and tendon injuries, the inflammatory phase is the body's immediate response to tissue damage, characterized by the infiltration of immune cells and the release of cytokines and growth factors that mediate the healing process. However, there are distinctions in the molecular and cellular dynamics based on tissue type.

Muscle:

The inflammatory phase in muscle is relatively short, typically lasting only a few days due to the high vascularity, which accelerates immune cell recruitment and clearance of debris.

Cytokines and Growth Factors:

Interleukin-1 (IL-1) and Tumor Necrosis Factor-alpha (TNF-α) are released by infiltrating neutrophils and macrophages, promoting local inflammation and recruiting additional immune cells.

Interleukin-6 (IL-6) plays a dual role in both inflammation and the activation of satellite cells (muscle stem cells) that initiate muscle regeneration.

Transforming Growth Factor-beta (TGF-β) is released later in the inflammatory phase to promote fibrosis and scar formation if the injury is severe. However, TGF-β can also recruit fibroblasts and stimulate the production of extracellular matrix.

Macrophage-Derived Growth Factor (MDGF) and Platelet-Derived Growth Factor (PDGF) help transition the inflammatory phase into the proliferative phase by stimulating cell migration and proliferation.

Tendon:
In tendons, the inflammatory phase is more prolonged (several days to a week) due to the lower blood supply, leading to slower clearance of debris and delayed initiation of repair mechanisms.

Cytokines and Growth Factors:

TNF-α and IL-1 dominate early in the inflammatory phase, but the cytokine cascade in tendon injuries persists longer due to the slower infiltration of immune cells.

TGF-β plays a critical role in recruiting fibroblasts (tenocytes) to the injury site and regulating the synthesis of collagen and other matrix proteins.

PDGF and Fibroblast Growth Factor (FGF) are involved in stimulating tenocyte proliferation and matrix production, which are key to the later proliferative phase.

Vascular Endothelial Growth Factor (VEGF) is upregulated during this phase to promote angiogenesis, which is crucial for bringing oxygen and nutrients to the poorly vascularized tendon tissue.

2. Proliferative Phase:
The proliferative phase is characterized by tissue regeneration and the deposition of new extracellular matrix components, including collagen. Both muscle and tendon undergo active repair during this phase, but the mechanisms and timeframes differ.

Muscle:
Muscle's proliferative phase is rapid due to its regenerative capacity, particularly through the activation of satellite cells, which differentiate into myoblasts and fuse to form new muscle fibers.

Cytokines and Growth Factors:
Hepatocyte Growth Factor (HGF) and IGF-1 are essential for activating satellite cells. HGF triggers the proliferation of satellite cells, while IGF-1 promotes their differentiation into myoblasts.

Fibroblast Growth Factor (FGF) stimulates angiogenesis and the proliferation of myoblasts.

IL-6 continues to play a role in muscle fiber formation, particularly in regulating satellite cell differentiation.

TGF-β, while important for scar formation, is downregulated during this phase to minimize fibrosis and promote more functional tissue regeneration.

Tendon:
Tendon tissue heals more slowly and primarily through fibroplasia, where tenocytes proliferate and produce new collagen fibers, predominantly Type III collagen at this stage.

Cytokines and Growth Factors:

TGF-β remains highly active in tendon healing, stimulating tenocyte proliferation and collagen synthesis. However, excessive TGF-β activity can lead to scar tissue formation.

PDGF and FGF continue to drive fibroblast activity, ensuring a steady supply of collagen and matrix proteins for repair.

VEGF is still upregulated during the proliferative phase to support the formation of new blood vessels, ensuring nutrient supply to the healing tendon.

Connective Tissue Growth Factor (CTGF) is another critical factor, working in conjunction with TGF-β to regulate collagen synthesis and extracellular matrix organization in tendons.

3. Remodeling Phase:
The remodeling phase is when the newly formed tissue matures, with collagen realigning to restore the mechanical properties of the tissue. The remodeling phase is more protracted in tendons compared to muscle and results in different levels of functional recovery.

Muscle:
Muscle fibers align along functional lines of stress, and the extracellular matrix is remodeled to support optimal muscle function. The regenerative capacity of muscle allows for near-normal restoration of tissue architecture, though some fibrosis may persist in severe injuries.

Cytokines and Growth Factors:

IGF-1 and HGF continue to be involved in the final stages of muscle fiber maturation and alignment, ensuring the functional integration of newly formed myofibers.

Matrix Metalloproteinases (MMPs) are upregulated to degrade excess extracellular matrix and remodel the scar tissue, allowing more efficient tissue function.

IL-6 continues to contribute to muscle fiber repair and growth, ensuring the integration of newly formed fibers with the existing muscle tissue.

Tendon:
In tendons, the remodeling phase involves the gradual replacement of Type III collagen with stronger, more organized Type I collagen. This process takes months to years, and the final tissue often lacks the mechanical properties of uninjured tendon tissue, resulting in a fibrotic scar.

Cytokines and Growth Factors:

TGF-β remains central to the remodeling phase in tendons, promoting collagen reorganization and the continued deposition of Type I collagen.

MMPs play a crucial role in breaking down disorganized collagen, facilitating the realignment of collagen fibers along lines of mechanical stress.

TIMP (Tissue Inhibitors of Metalloproteinases) regulate MMP activity, ensuring a balance between collagen degradation and synthesis to prevent excessive matrix breakdown.

CTGF continues to support matrix remodeling and stabilization, helping to maintain the structural integrity of the healing tendon.

Key Differences:

Regenerative Capacity: Muscle has a greater capacity for true regeneration through the activation of satellite cells, while tendons primarily heal through scar formation due to limited regenerative potential. Growth factors like IGF-1 and HGF are more central to muscle healing, while TGF-β and PDGF are more active in tendon repair.

Duration of Healing: Tendon healing takes longer than muscle healing due to its poorer blood supply and slower collagen turnover. Growth factors like VEGF and FGF are critical in promoting angiogenesis and collagen synthesis in both tissues, but the response is more prolonged in tendons.

Outcome: Muscle injuries often result in more complete functional recovery, aided by the efficient regeneration of muscle fibers. Tendon injuries, however, tend to leave behind structurally weaker scar tissue, which leads to reduced elasticity and a higher risk of re-injury.

Clinical Implications:

Muscle Injuries: Early mobilization and controlled activity can enhance muscle fiber regeneration and minimize fibrosis. Overloading can disrupt the regenerative process and lead to excessive scar formation.

Tendon Injuries: Controlled loading and mechanical stress are critical to stimulate proper collagen remodeling in tendons. Early overloading can lead to disrupted healing and increase the risk of tendinosis or re-injury due to the formation of inferior scar tissue.

Supplements to aid in the Phases of Musculoskeletal Healing: Muscle vs. Tendon

Nutrition plays a vital role in the healing process following musculoskeletal injuries, particularly for muscle and tendon repair. Adequate nutrient intake is essential for the synthesis and action of various growth factors and cytokines, which are key regulators in the inflammatory and proliferative phases of healing. Inadequate nutrition can negatively affect the production, signaling, and function of these molecules, thus impairing the healing response in muscle and tendon tissues.

Muscle Healing

Inflammatory Phase (Days 1-5)

During this phase, the primary goal is to manage inflammation and promote an acute healing response. Recommended supplements include a multivitamin (1 daily serving) to support immune function, Omega-3 fatty acids (1000 mg combined EPA and DHA) to reduce inflammation, Vitamin C (500 mg) to promote collagen synthesis, Zinc (15 mg) to aid immune response, and Curcumin (500 mg with black pepper for absorption) to provide anti-inflammatory support.

Proliferative Phase (Days 5-14)

The focus shifts to tissue repair and the formation of new cellular structures. Supplements include a multivitamin (1 daily serving) for continued nutrient support, protein supplements to achieve a total intake of 1.5 to 2.2 grams/kg body weight for collagen synthesis, Omega-3 fatty acids (1000 mg), Vitamin C (500 mg), Zinc (15 mg), Vitamin D (1000-2000 IU) for bone health, and insulin-like growth factor (IGF) support to aid muscle regeneration.

Remodeling Phase (Weeks 2+)

This phase emphasizes strengthening and optimizing the function of the repaired muscle tissue. Ongoing supplementation includes a multivitamin (1 daily serving), Omega-3 fatty acids (1000 mg), collagen peptides (10 grams optional), Vitamin C (500 mg), Zinc (15 mg), Vitamin D (1000-2000 IU), and protein supplements as needed to maintain 1.5 to 2.2 grams/kg body weight for ongoing muscle strength development.

Tendon Healing

Inflammatory Phase (Days 1-5)

In tendon injuries, the inflammatory phase often has a prolonged response due to lower vascularity. Recommended supplements include a multivitamin (1 daily serving), Omega-3 fatty acids (1000 mg combined EPA and DHA), Vitamin C (500 mg), Zinc (15 mg), and Curcumin (500 mg) for anti-inflammatory benefits.

Proliferative Phase (Days 5-14)

This phase involves the deposition of new collagen fibers, primarily Type III. Supplements should consist of a multivitamin (1 daily serving), protein supplements to achieve a total intake of 1.2 to 2.0 grams/kg body weight, Omega-3 fatty acids (1000 mg), Vitamin C (500 mg), Zinc (15 mg), Vitamin D (1000-2000 IU) for enhancing healing, and TGF-β support through dietary sources to stimulate collagen synthesis in tendons.

Remodeling Phase (Weeks 2+)

Focusing on collagen organization and increasing tensile strength, the recommended supplements include a multivitamin (1 daily serving), Omega-3 fatty acids (1000 mg), collagen peptides (10 grams optional), Vitamin C (500 mg), Zinc (15 mg), Vitamin D (1000-2000 IU), and protein supplements to maintain a total intake of 1.2 to 2.0 grams/kg body weight for tendon strength development.

Overall, a targeted nutritional approach can significantly enhance recovery during all phases of healing for both muscles and tendons.

Inflammatory Phase (Days 1-5)

Healing Phase	Muscle	Tendon
Inflammatory Phase (Days 1-5)	**Supplements:**	**Supplements:**
	- Multivitamin (1 daily serving): Supports immune function	- Multivitamin (1 daily serving): Supports overall health
	- Omega-3 (1000 mg EPA+DHA): Reduces inflammation	- Omega-3 (1000 mg EPA+DHA): Modulates inflammation
	- Vitamin C (500 mg): Collagen synthesis	- Vitamin C (500 mg): Collagen synthesis
	- Zinc (15 mg): Immune response	- Zinc (15 mg): Enhances immune response
	- Curcumin (500 mg): Anti-inflammatory	- Curcumin (500 mg): Anti-inflammatory

Proliferative Phase (Days 5-14)

Healing Phase	Muscle	Tendon
Proliferative Phase (Days 5-14)	**Supplements:**	**Supplements:**
	- Multivitamin (1 daily serving): Essential nutrients	- Multivitamin (1 daily serving): Essential nutrients
	- Protein (1.5-2.2 g/kg): Collagen synthesis	- Protein (1.2-2.0 g/kg): Amino acids for collagen
	- Omega-3 (1000 mg EPA+DHA): Supports healing	- Omega-3 (1000 mg EPA+DHA): Supports healing
	- Vitamin C (500 mg): Continued collagen synthesis	- Vitamin C (500 mg): Continued collagen synthesis
	- Zinc (15 mg): Supports cytokine production	- Zinc (15 mg): Growth factor production
	- Vitamin D (1000-2000 IU): Immune and bone support	- Vitamin D (1000-2000 IU): Tendon healing
	- IGF Support (Dietary): Muscle regeneration	- TGF Support (Dietary): Collagen synthesis

Remodeling Phase (Weeks 2+)

Healing Phase	Muscle	Tendon
Remodeling Phase (Weeks 2+)	**Supplements:**	**Supplements:**
	- Multivitamin (1 daily serving): Ongoing nutrient support	- Multivitamin (1 daily serving): Ongoing nutrient support
	- Omega-3 (1000 mg EPA+DHA): Healthy inflammation balance	- Omega-3 (1000 mg EPA+DHA): Inflammation management
	- Collagen Peptides (10 g): Collagen synthesis	- Collagen Peptides (10 g): Collagen remodeling
	- Vitamin C (500 mg): Collagen maturation	- Vitamin C (500 mg): Collagen maturation
	- Zinc (15 mg): Tissue repair	- Zinc (15 mg): Ongoing repair
	- Vitamin D (1000-2000 IU): Muscle and bone support	- Vitamin D (1000-2000 IU): Tissue adaptation
	- Protein (1.5-2.2 g/kg): Muscle strength	- Protein (1.2-2.0 g/kg): Tendon strength

See below for specific diet plans.

7-Day Healing Menu (Inflammatory Stage)

Day	Breakfast	Lunch	Dinner	Snack	Supplements
1	Scrambled eggs with spinach and avocado, whole grain toast, orange juice	Grilled salmon, quinoa salad with mixed greens	Baked chicken breast with turmeric, sweet potato, steamed broccoli	Greek yogurt with berries	Multivitamin, Omega-3 (1000 mg), Zinc (15 mg), Curcumin (500 mg)
2	Oatmeal with flaxseeds and blueberries, green tea	Turkey and avocado wrap, carrot sticks, orange slices	Grilled mackerel with lemon, brown rice, roasted Brussels sprouts	Handful of walnuts	Multivitamin, Omega-3, Vitamin C (500 mg), Zinc
3	Smoothie with spinach, banana, chia seeds, whole wheat toast	Lentil and vegetable soup, whole grain bread, grapefruit	Roast chicken with rosemary, quinoa, roasted carrots	Cottage cheese with pineapple chunks	Multivitamin, Omega-3, Curcumin, Zinc
4	Greek yogurt with flaxseeds and strawberries, whole grain granola	Tuna salad with olive oil, lemon, mixed greens, sliced apple	Grilled shrimp with garlic and turmeric, steamed spinach, brown rice	Handful of pumpkin seeds	Multivitamin, Omega-3, Vitamin C, Zinc
5	Scrambled eggs with tomatoes and avocado, fresh orange juice	Chicken and avocado salad with mixed greens, sliced bell peppers	Grilled cod with turmeric, mashed sweet potatoes, steamed asparagus	Almonds	Multivitamin, Omega-3, Zinc, Curcumin
6	Smoothie with kale, banana, chia seeds, whole wheat toast with almond butter	Quinoa and chickpea salad with olive oil, sliced cucumbers and tomatoes	Baked salmon with lemon, quinoa, roasted Brussels sprouts	Low-fat Greek yogurt with chia seeds	Multivitamin, Omega-3, Vitamin C, Zinc
7	Oatmeal with walnuts, flaxseeds, blueberries, green tea	Grilled chicken breast with mixed green salad, sliced avocado and lemon	Grilled turkey burger with whole grain bun, sweet potato fries, steamed broccoli	Handful of sunflower seeds	Multivitamin, Omega-3, Curcumin, Zinc

Feel free to modify any meals or snacks based on personal preferences or dietary restrictions!

7-Day Healing Menu (Proliferative Stage)

Day	Breakfast	Lunch	Dinner	Snack	Supplements
1	Protein smoothie with spinach, banana, and almond milk	Grilled chicken salad with mixed greens, quinoa, and vinaigrette	Baked salmon with brown rice and steamed broccoli	Hummus with carrot sticks	Multivitamin, Omega-3 (1000 mg), Vitamin C (500 mg), Zinc (15 mg), IGF Support
2	Oatmeal with protein powder, sliced almonds, and berries	Turkey and avocado wrap with whole grain tortilla, side salad	Stir-fried tofu with vegetables and brown rice	Greek yogurt with honey	Multivitamin, Omega-3, Vitamin D (1000 IU), Zinc, IGF Support
3	Scrambled eggs with spinach and whole grain toast	Lentil soup with whole grain bread and a side of fruit	Grilled shrimp with quinoa and roasted vegetables	Cottage cheese with sliced peaches	Multivitamin, Omega-3, Vitamin C, Zinc, IGF Support
4	Smoothie with kale, banana, and protein powder	Quinoa and black bean salad with lime dressing	Baked chicken thighs with sweet potato and green beans	Handful of mixed nuts	Multivitamin, Omega-3, Vitamin D, Zinc, IGF Support
5	Greek yogurt with granola and mixed berries	Tuna salad with mixed greens and whole grain crackers	Grilled turkey burger with avocado, sweet potato fries	Sliced apple with almond butter	Multivitamin, Omega-3, Vitamin C, Zinc, IGF Support
6	Chia seed pudding with almond milk and fruit	Chicken and vegetable stir-fry with brown rice	Baked cod with steamed broccoli and quinoa	Handful of pumpkin seeds	Multivitamin, Omega-3, Vitamin D, Zinc, IGF Support
7	Whole grain pancakes with protein powder and berries	Grilled vegetable and hummus wrap with side salad	Stir-fried beef with bell peppers, served over brown rice	Greek yogurt with chia seeds	Multivitamin, Omega-3, Vitamin C, Zinc, IGF Support

Feel free to adjust any meals or snacks according to your tastes or dietary needs!

7-Day Healing Menu (Remodeling Stage)

Day	Breakfast	Lunch	Dinner	Snack	Supplements
1	Protein smoothie with berries, spinach, and almond milk	Grilled chicken with brown rice and steamed broccoli	Baked salmon with quinoa and asparagus	Handful of walnuts	Multivitamin, Omega-3 (1000 mg), Vitamin C (500 mg), Zinc (15 mg), Collagen Peptides (10 g)
2	Oatmeal with protein powder, sliced bananas, and almonds	Quinoa salad with chickpeas, cucumber, and feta	Turkey stir-fry with mixed vegetables and brown rice	Greek yogurt with berries	Multivitamin, Omega-3, Vitamin D (1000 IU), Zinc, Collagen Peptides
3	Scrambled eggs with spinach and whole grain toast	Lentil and vegetable soup with whole grain bread	Grilled shrimp tacos with avocado and salsa	Cottage cheese with sliced pineapple	Multivitamin, Omega-3, Vitamin C, Zinc, Collagen Peptides
4	Smoothie with kale, banana, protein powder, and almond milk	Chicken salad with mixed greens, walnuts, and vinaigrette	Baked cod with sweet potatoes and green beans	Handful of mixed nuts	Multivitamin, Omega-3, Vitamin D, Zinc, Collagen Peptides
5	Greek yogurt with granola and mixed fruit	Tuna salad with whole grain crackers and carrot sticks	Grilled chicken with quinoa and roasted Brussels sprouts	Sliced apple with almond butter	Multivitamin, Omega-3, Vitamin C, Zinc, Collagen Peptides
6	Chia seed pudding with almond milk and berries	Chicken stir-fry with vegetables over brown rice	Baked turkey breast with mashed sweet potatoes and steamed broccoli	Handful of pumpkin seeds	Multivitamin, Omega-3, Vitamin D, Zinc, Collagen Peptides
7	Whole grain pancakes with protein powder and fruit	Quinoa and black bean bowl with avocado and salsa	Stir-fried beef with broccoli served over brown rice	Greek yogurt with chia seeds	Multivitamin, Omega-3, Vitamin C, Zinc, Collagen Peptides

Feel free to make any adjustments based on your preferences or dietary needs!

See bibliography and further reading below:

The impact of nutrition on tendon health and tendinopathy
Authors: de Vos, R.J., et al.
Journal: Scandinavian Journal of Medicine & Science in Sports, 2022.
Summary: This systematic review evaluates the influence of various nutrients on the prevention and treatment of tendinopathy, highlighting the potential benefits of dietary supplements, particularly collagen-derived peptides, in tendon health. PubMed Central

Nutritional Considerations for Injury Prevention and Recovery in Combat Sports
Authors: Tipton, K.D., et al.
Journal: Nutrients, 2021.
Summary: This review discusses the role of macro- and micronutrients, total energy intake, and food supplements in preventing injuries and enhancing recovery in combat sports, with a focus on skeletal muscle, bone, tendons, ligaments, and sports-related concussions. PubMed Central

Nutritional Strategies in the Rehabilitation of Musculoskeletal Injuries
Authors: Close, G.L., et al.
Journal: Nutrients, 2023.
Summary: This article explores nutritional strategies that benefit the rehabilitation process in injured athletes, emphasizing balanced energy intake and high-protein and carbohydrate-rich diets to support musculoskeletal recovery. MDPI

Nutritional Support for Injuries Requiring Reduced Activity
Authors: Pasiakos, S.M., et al.
Journal: Sports Science Exchange, 2018.
Summary: This paper provides recommendations for nutrient intake, including anti-inflammatory and antioxidant nutrients like omega-3 fatty acids and vitamins, to support recovery during periods of reduced physical activity due to injury. GSSI

A high-glucose diet affects Achilles tendon healing in rats"
Authors: Ackerman, J.E., et al.
Journal: Scientific Reports, 2017.
Summary: This study investigates how a high-glucose diet impacts tendon healing, suggesting that elevated glucose levels may adversely affect tendon repair processes, potentially driving chondrogenic degeneration. Nature