NUTRITIONAL SUPPORT FOR INJURY RECOVERY

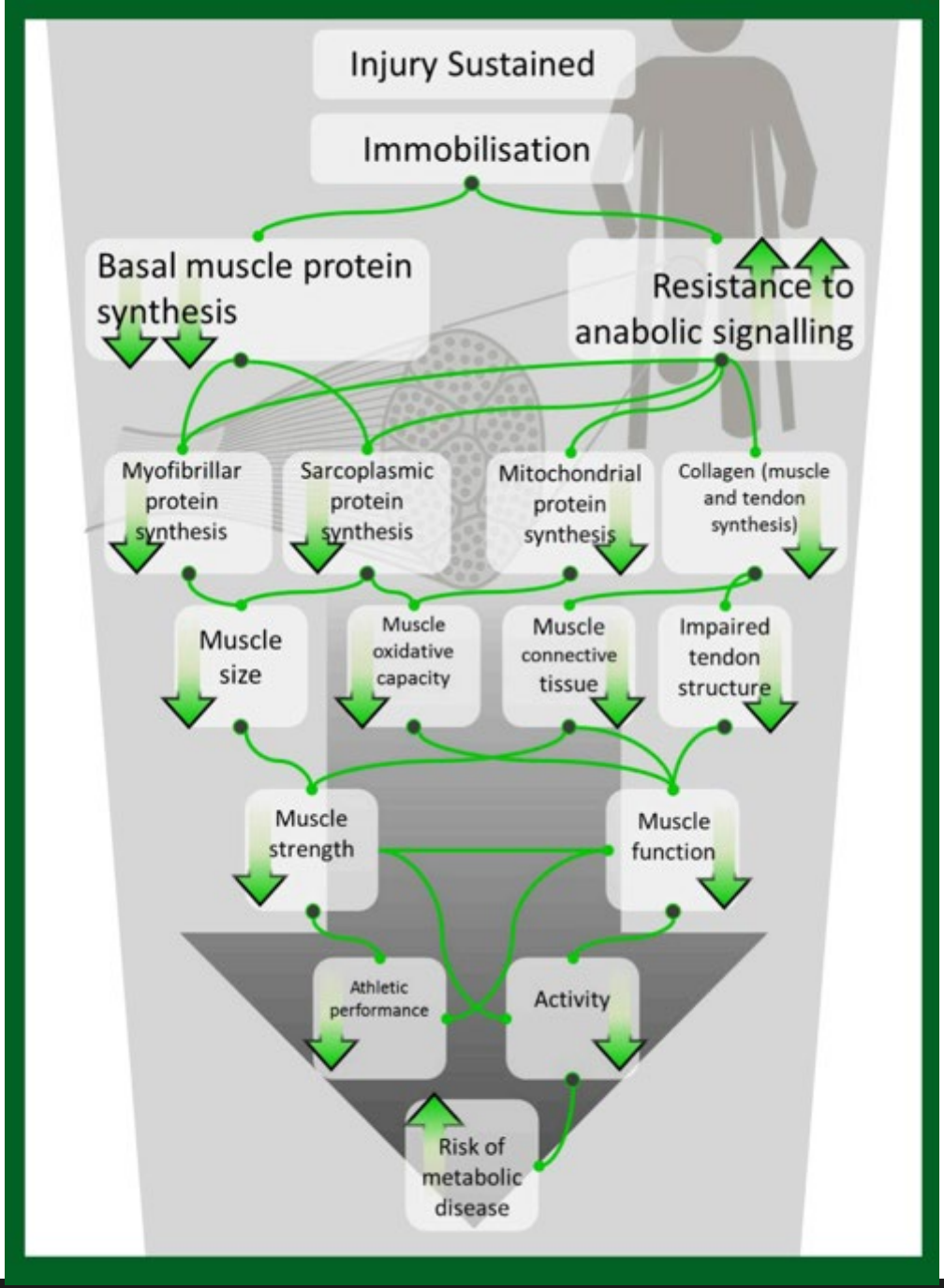
GATORADE SPORTS SCIENCE INSTITUTE

OVERVIEW

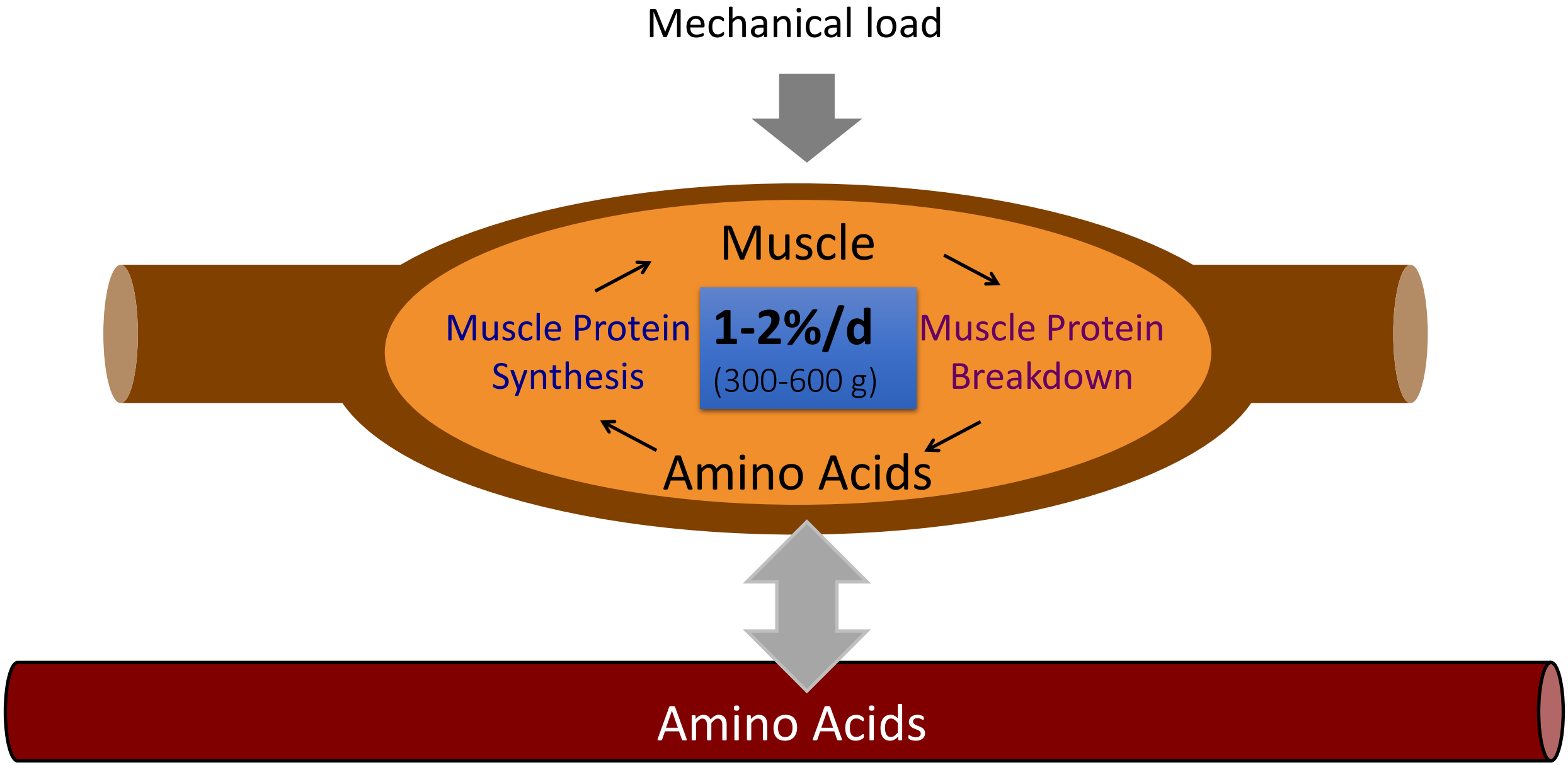
- Muscle tissue – minimize atrophy
- Connective tissue
- Bone
- Inflammation & Pain
- Energy

Metabolic and Functional Consequences of Immobilization Following an Exercise-Induced Injury

SSE #169



Tipton K. *Sports Science Exchange*. 2017;28(169):1-6


Mechanical load
Muscle
Muscle Protein Synthesis
1-2%/d
(300-600 g)
Muscle Protein Breakdown
Amino Acids
Amino Acids

How much muscle do you think can be lost per day when your leg is in a cast?

IMMOBILIZATION

1-2 Weeks of Immobilization:

- Healthy, inactive muscle atrophies ~0.5% per day
- 150-400 g muscle can be lost
- Strength decreases at 3x the rate muscle tissue is lost

Wall BT, Morton JP, van Loon LJC. *EJSS*. 2015;15(1):53-62.

IMMOBILIZATION

Resulting In:

↓ **MPS**

Anabolic resistance
(decreased response to protein)

↓ **Calories** accelerates muscle loss

Wall BT, Morton JP, van Loon LJC. *EJSS*. 2015;15(1):53-62.

PROMOTING RETURN TO PLAY

Immediate need for countermeasures to decrease atrophy & support rehabilitation

Usually little/no exercise intervention

Need non-exercise strategies

Alleviate anabolic resistance through nutrition

Tipton, K. Sports Med. 2015; 45:93-104, doi: 10.1007/s40279-015-0398-4.

ANABOLIC RESISTANCE

Protein Intake Helps to Manage Anabolic Resistance

- 1.6-2.5 g/kg/d protein
- 20-40 g every 3-4 h
- Pre-Sleep (casein?)
- Leucine

Wall BT, Morton JP, van Loon LJC. *EJSS*. 2015;15(1):53-62

LEUCINE

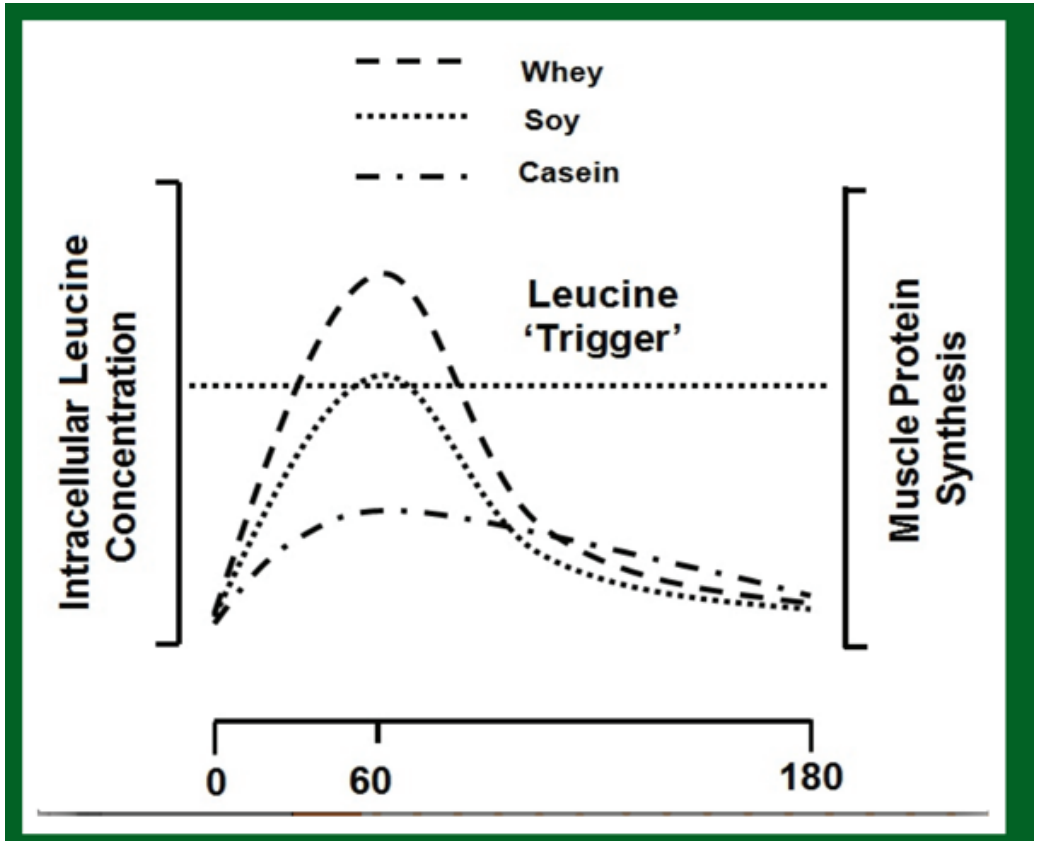


Figure 4: The 'leucine trigger' concept with data adapted from (Tang et al., 2009) as shown for whey protein, soy protein, and casein proteins. These proteins would be digested in the following order: whey ≥ soy >> casein, and the following leucine content: whey > casein > soy. Thus, a greater and more rapid rise in blood leucine triggers a greater rise in MPS.

Building block for new muscle

Signaling molecule to initiate muscle protein synthesis

SSE #107

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Phillips, S. *Sports Science Exchange* (2013) Vol. 26, No. 107, 1-5.

OTHER NUTRITIONAL CONSIDERATIONS

- **HMB?** (3 g/d)
- **Creatine?** (20 g/d)
- **Fish oil?** (4-5 g/d)

Wall BT, Morton JP, van Loon LJC. *EJSS*. 2015;15(1):53-62

OTHER NUTRITIONAL CONSIDERATIONS

HMB

b-hydroxyl-b-methylbutyrate

- Metabolite of leucine
- May increases MPS, decrease breakdown
- Preserved muscle mass during bed rest in older adults
- Likely not beneficial for healthy athletes; more research needed during injury

Creatine

- Slowed loss of muscle during 7 d upper arm immobilization
- Did not preserve muscle or strength during 7 d leg immobilization

Fish Oil

- May promote anabolism by increasing sensitivity to amino acid ingestion
- In one study, slowed decreases in muscle thickness, arm girth and BMC during arm immobilization

Backx EMP, Hangelbroek R, Snjiders T, et. al. *Sports Med*. 2017;47:1661-1671
Bostock EL, Morse CI, Winwood K, et. al. *J Nutr Health Aging*. 2017;21:51-58
Rawson ES, Miles MP, Larson-Meyer DE. *Int J Sport Nutr Exerc Metab*. 2018;28(2):188-199
Wall BT, Morton JP, van Loon LJC. *EJSS*. 2015;15(1):53-62

TREAT REHAB LIKE TRAINING

- 20-40 g (~0.25-0.3 g/kg)protein shortly after each rehab session
- Leucine-rich, complete protein
- Regular protein intake pattern
- Limit/avoid alcohol

Macnaughton LS, Wardle SL, Witard OC, et. al. *Physiol Rep*. 2016;4(15)
Moore DR, Robinson MJ, Fry JL, et. al. *AJCN*. 2009;89(1):161-8
Witard OC, Jackman SR, Breen L, et. al. *AJCN*. 2013;99(1):86-95,2013

EXAMPLE STUDY

30 individuals
ACL injury

3x/week
12 weeks

PRO (10 g)

Post-exercise protein improved:

Quadriceps CSA

Peak torque

*With only 10 g protein!

Holm L, Esmark B, Mizuno M, et. al. *J Orthop Res.* 2006;24(11):2114-23

LIGAMENT HEALING

Vitamin C + Amino Acids (proline, lysine, hydroxyproline, hydroxylysine) = ↑ **collagen synthesis**

48 mg

Gelatin (15 g)

1 hour prior to 6 min rope skipping

Dr. Keith Baar
UC Davis

Shaw G, Lee-Barthel A, Ross MLR, et al. *Am J*

LIGAMENT HEALING

Consuming Vitamin C-enriched gelatin or a collagen supplement prior to rehab exercises may help promote healing of connective tissue

Dr. Keith Baar
UC Davis

SSE #142

Baar K. *Sports Science Exchange*. 2015(142): 1-6

SSE #187

Baar K. *Sports Science Exchange*. 2018;29(187):1-6

How to Deliver Gelatin: Gummie Recipe from Dr. Baar.

Keith Baar
@MuscleScience

Here is the recipe that I use to get a high concentration in a gummie

FMBLab
Nutrition

Building Blox Recipe

Ingredients

8 Servings

- 80g (½ cup) of Knox® Gelatin
- 80g (½ cup) of Great Lakes Hydrolyzed Collagen
- 1½ Cup Vit C enriched juice (Ribena)
- 1 Cup water
- 500 mg of vitamin C if not using Vit C enriched

* use a type of juice that is a favorite of the house. Most are sweet enough to not need any sugar. Nutrition calculated using Ribena®.

Directions

1. Bring 1½ cups of Ribena® to a boil.
2. Meanwhile, mix gelatin and collagen into the cup of water.
3. Add the hot juice to the gelatin and stir until dissolved
4. Pour gelatin into molds or a flat tray or use ice cube/candy molds
5. Place in the fridge to set.
6. Cut into 8-10 pieces
7. Eat one piece 30-60min before training

Gel Blox Nutrition

Amount	1/8 recipe
Calories	168kcal
FAT (g)	0
CHO (g)	31.9
PRO (g)	10

This is a dairy, nut and gluten free food.

For Further Information Contact:

Dr. Keith Baar, PhD
(530) 400-2188
kbaar@ucdavis.edu

Follow us on Twitter:
@MuscleScience

Food for Thought

Including gelatin in a rehab program or consuming gelatin 30-60 minutes before training is thought to improve collagen synthesis (make ligaments, bones and tendons stronger), prevent injury, and accelerate return to play after injury to bone, tendon, ligament, and cartilage.

BONE INJURY

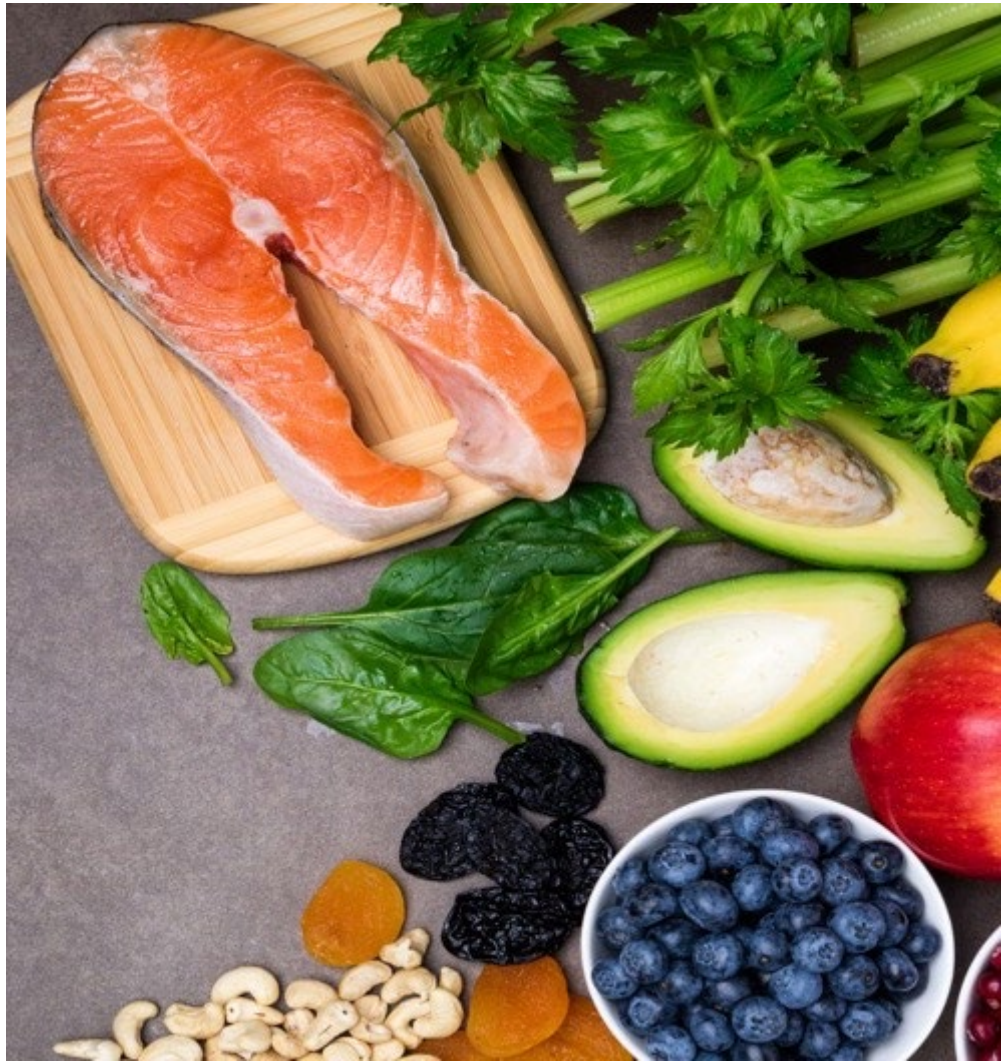
Ensure consumption of the RDA for calcium (1000 mg/d)

Consider assessing Vitamin D status

Consume adequate calories

Sale C & Elliot-Sale K. *Sports Science Exchange*. 2020;29(201):1-7

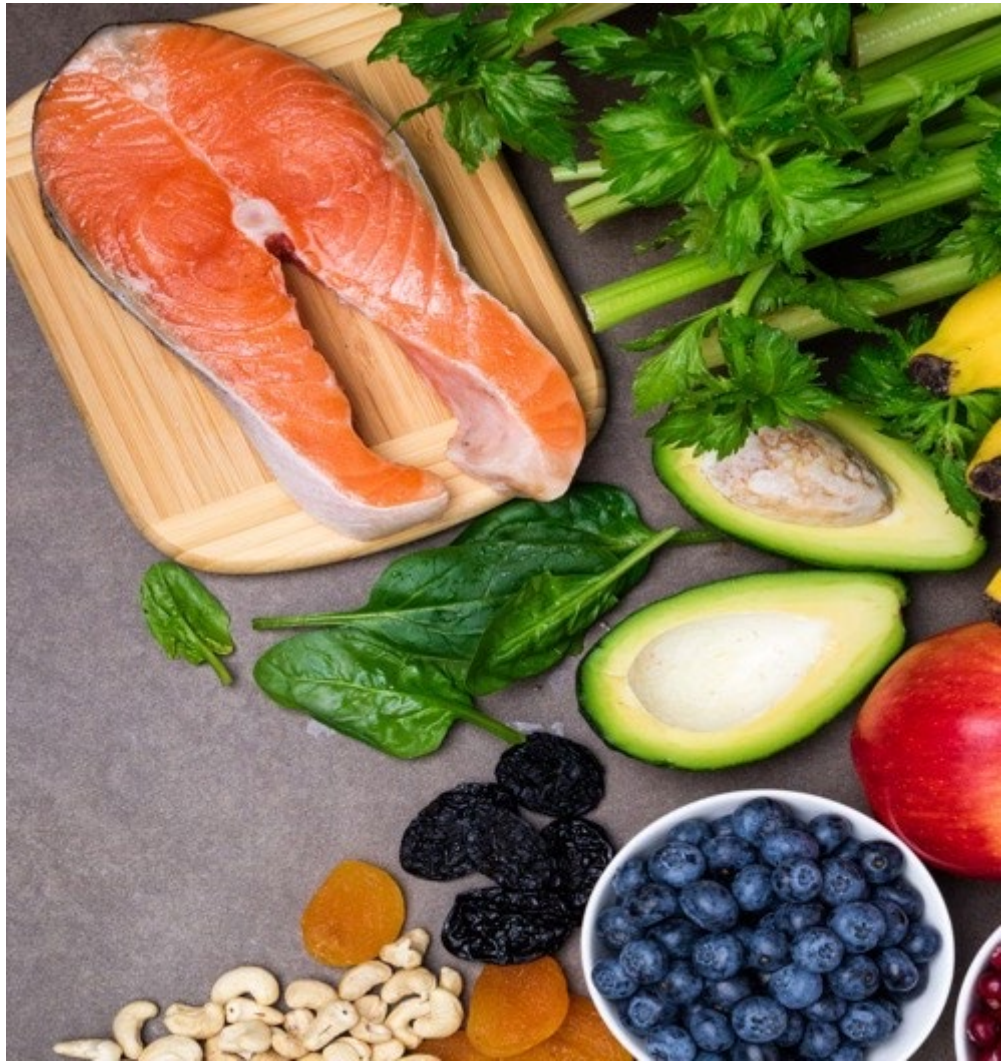
MANAGING INFLAMMATION



- ✓ Acute inflammation important for wound healing
- ✓ Chronic inflammation impairs recovery
- ✓ Analgesics target inflammatory pathways

Tipton, K. Sports Med. 2015; 45:93-104, doi: 10.1007/s40279-015-0398-4.

MANAGING INFLAMMATION



In an otherwise healthy athlete, an injury is unlikely to cause uncontrolled inflammation

Use caution and judgement when suggesting anti-inflammatory foods in the acute phase post-injury

Tipton, K. Sports Med. 2015; 45:93-104, doi: 10.1007/s40279-015-0398-4.

Do you think an athlete should restrict calories when injured? Why or why not?

ENERGY NEEDS

Ensuring the right energy balance promotes healing

Measure RMR if possible

Monitor for significant changes in body weight

Tipton, K. Sports Med. 2015; 45:93-104, doi: 10.1007/s40279-015-0398-4.

ENERGY NEEDS

Resting EE may increase ~15-50% with injury

Crutching increases EE 2-3x

Reduced activity

Energy needs of healing

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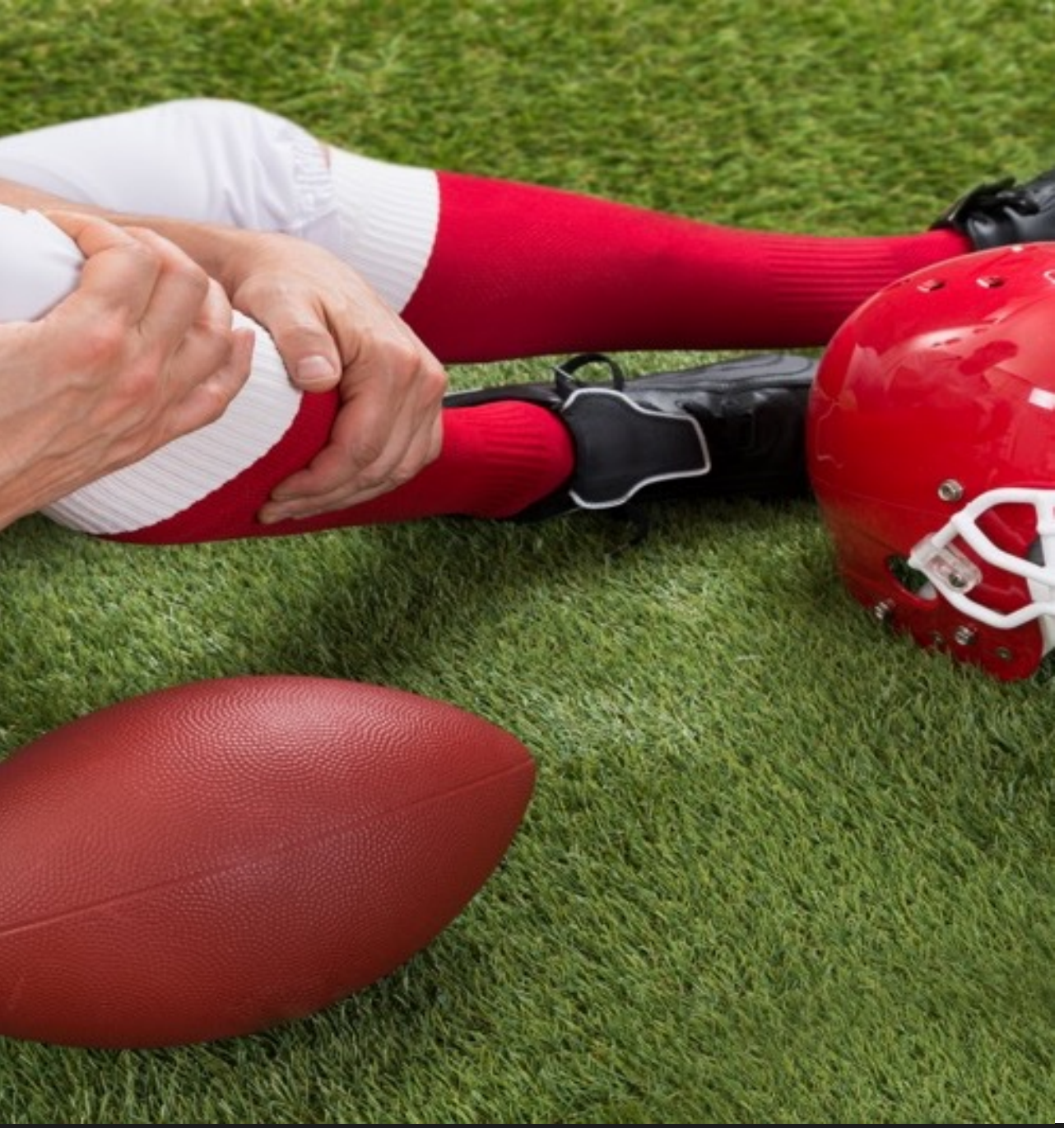

Summary

"The single most important nutritional consideration during reduced muscle activity and/or immobility is to avoid nutrient deficiencies. Deficiencies of energy, vitamins, minerals and macronutrients—particularly protein—will impair wound healing and exacerbate loss of muscle and tendon mass and function. Whereas healthy exercisers and athletes are unlikely to suffer from malnourishment, choices made during recovery from an injury need to be carefully considered to optimize recovery and return to training."

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KEY TAKEAWAYS

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