



# Nutritional & Metabolic Considerations in ACL Return to Play

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**SPORTS MEDICINE**  
CENTER  
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# Game Plan

- 1 Metabolic Adaptations
- 2 Energy & Macronutrient Needs
- 3 Other Nutrients of Interest
- 4 Tools for Healthcare Providers

# Anabolic Resistance

- Muscle mitochondrial oxidative function
- Mitochondrial protein transcription
- Response to anabolic stimulus
- mTORC1 signaling
- Translational signaling pathways involved in mitochondrial biogenesis
- Mitochondrial enzyme activities (as early as 48hrs)
- Insulin sensitivity
- GLUT4 activity

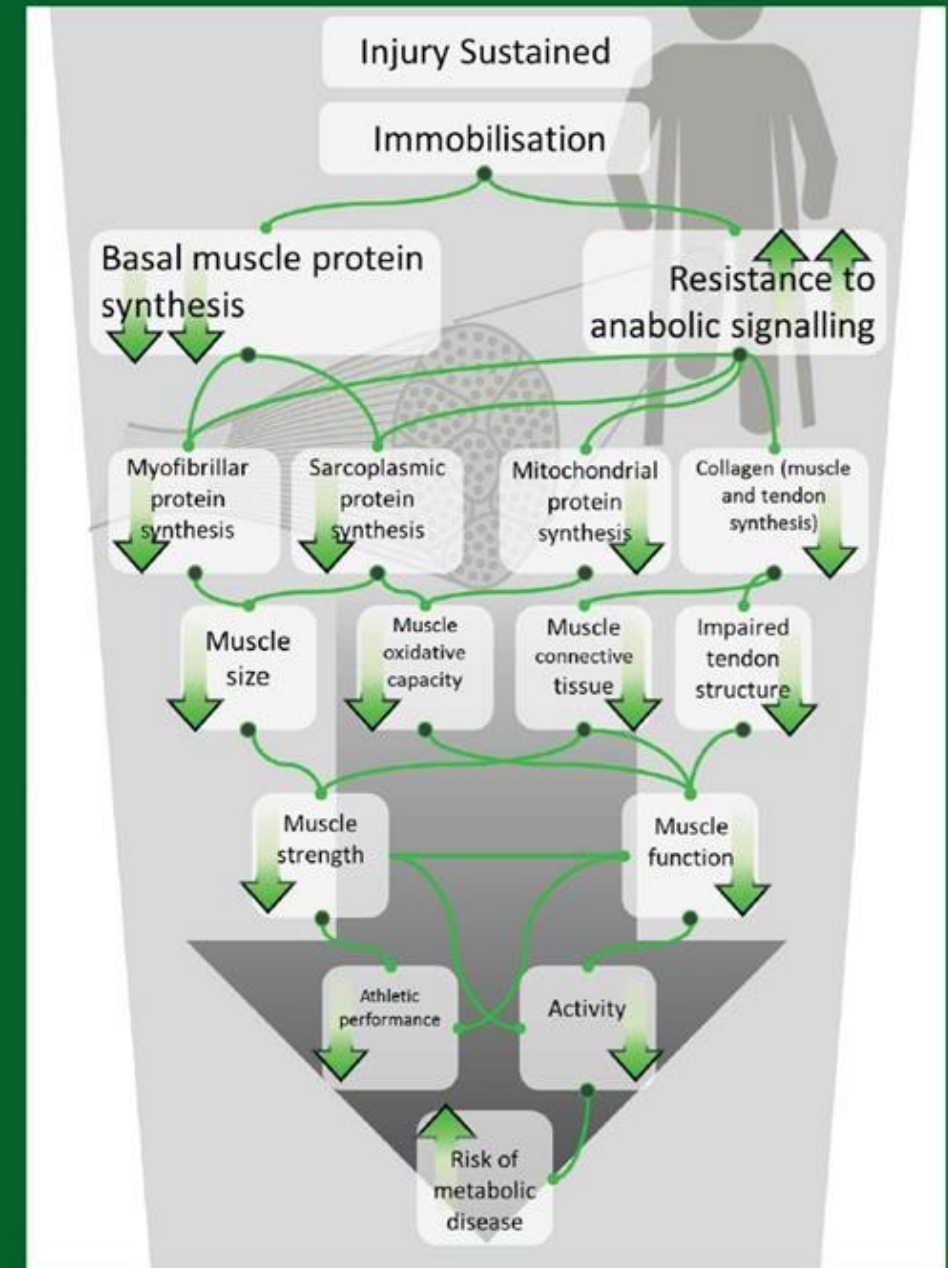


Figure 1. Schematic diagram depicting the metabolic and functional consequences of immobilization following an exercise-induced injury.

# Estimating Energy Needs

## Factors affecting energy needs:

Activity Changes	Ambulation type/efficiency
Protein Turnover	well-muscled adult male expends ~500 kcal a day on MPS
Healing	15% - 50% increase in energy need

\*Spontaneous energy intake matches expenditure over time

# Energy Needs

## Hypocaloric intake

- poor wound healing
- increased muscle loss

## Presentation:

- Fear of weight gain
- Skipping meals
- Not eating when hungry/low hunger drive

## Hypercaloric intake

- systemic inflammation
- accelerates muscle loss

## Presentation:

- Feeling overfull at meals
- Eating for comfort/boredom, grazing all day



# Consequences on the Athlete

Controllable factors:

- Nutrition
- Sleep

Expected changes:

- Body composition
- Weight

Contributors:

- Compliance
- Mental health
- Previous behavior

# Nutrient Needs

Nutrient Needs	
Carbohydrate	3-5g/kg
Fat	↑ omega 3
Micronutrients	Maintain RDA, adequacy pre-op, ⊘ megadoses
Protein	2-2.5g/kg

## Usual Practices

## Injury



### 2 tablespoons of fats

- Nuts and butters
- Avocado
- Oils
- Seeds
- Spreads (mayo, cream cheese)
- High-fat dairy products



### Drinks

- Water
- Milk
- Diluted juice
- Sports drinks



### Flavor ideas

- Salt and pepper
- Herbs
- Spices
- Vinegar
- Salsa
- Ketchup
- Mustard



### 1 teaspoon of fats

- Nuts and butters
- Avocado
- Oils
- Seeds
- Spreads (mayo, cream cheese)
- High-fat dairy products



### Drinks

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- Diluted juice



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# Carbohydrate

Fruits/veggies

Whole grains

Legumes

Moderate sweets/portion control

\*Drastic change from usual needs  
during sport



## Protein/Amino Acid Needs

- Usual 1.5g/kg/day for athletes
- .3g/kg/dose x 5/day



# Leucine

- Leucine has anti-catabolic effects and increases mTOR activity
- May help overcome effects of anabolic resistance
- In adults: 2-3g/meal
- Whey protein from dairy sources provides high dose of leucine



<b>Food</b>	<b>Portion</b>	<b>Protein (g)</b>	<b>Calories</b>
Milk (skim)	20oz	22	192
Soy drink	30oz	33	382
Milk powder (skim)	2.25oz	22	210
Cheese (2%)	2.5oz	22	184
Cheese (cottage, skim)	5oz (1.25 cup)	25	126
Yogurt (skim)	1.7 cup	20	186
Whey isolate	17g	16	70
Beef/poultry/seafood (raw, lean)	4.25oz	25	153
Almonds	4.5oz	26	765
Tofu (firm)	1 whole block	48	454
Kidney beans, canned	1.5 cups	23	310
Lentils, cooked	1 cup	18	195
Bread	9 slices	28	720
Rice (white, cooked)	6 cups	26	1434

Adapted from: Sports Dietitians Australia

# Supplements in Return to Play

# Supplement Considerations

- Largely unregulated in US market
- \$55+ billion/yr industry
- 3rd party verification
- Not recommended for <18y/o
- Muscle building, weight loss, and sexual enhancement highest risk of contamination



# Creatine

- Widely used to enhance muscle gains
- Shown to counteract disorders of the muscle
- Evidence for use of creatine to counter muscle loss during immobility is less clear
- Been shown to prevent decrease in GLUT 4 concentration during immobilization
- Efficacy of supplementation of muscle hypertrophy is established in adults and adolescents
- Safety deemed by ISSN: .3-.8g/kg from infant through elderly



## Omega 3's

- Long-term supplementation of EPA/DHA (4g/day) has demonstrated anabolic sensitivity to amino acids
- Sensitization of molecular pathways regulating muscle protein synthesis
- Cox-1 pathway inhibitor
- Withhold around surgery?
- Recommendation 3-6g/day for 6 weeks in adults





# Gelatin/Collagen

## Vitamin C enriched Gelatin

- No negative effects of using it to promote soft-tissue healing
- Some researchers have begun to feed athletes gelatin and have demonstrated positive responses on collagen production and return to play
- 15g with 50mg vit C, 1hr pre-loading exercise





## Beet Root Juice

- Nitric oxide is involved in multiple physiological processes including angiogenesis, wound healing and vasodilation
- Proliferation and differentiation of osteoblasts
- Decreased levels of nitric oxide have been associated with increased osteoclastogenesis and subsequent bone resorption
- Many of these studies are in early stages or in a murine model
- Still is substantial evidence on the role of nitrates and wound healing/normal bone remodeling



## Return to Play Plan of Care

### Protein

- 0.3g protein/kg x 5 meal periods per day
- Incorporating pro + vit C pre-workout may improve tendon response to exercise

### Carbohydrate

- Periodized for increasing activity
- 5-7g/kg
- 1g/kg pre-training minimum; 1.2g/kg post-training

### Micronutrient adequacy

- Vitamin C, zinc, iron, calcium, vit D

### Hydration

- 2-3L/d
- 13mL/kg/hr of exercise

### Supplementation?



# Summary

Encourage athletes to:

- Eat their high protein foods first
- Get 3-5 servings of fruits/veggies daily
- Eat foods high in omega-3's (salmon, tuna, mackerel, herring, chia, ground flax, walnuts)
- Limit low nutrient density foods (soda, desserts, fried foods)
- Drink water & avoid alcohol

Find a Sports Dietitian (CSSD) near the athlete:

- [Eatright.org](http://Eatright.org) - Find an Expert

Resources:

- CPSDA, USOC, APTA, NATA

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