REFUEL, REPAIR, REHYDRATE, REVITALIZE: SPORTS NUTRITION FOR OPTIMUM RECOVERY

Whether you've just finished a HIIT workout, completed a CrossFit WOD, hit your PR or finished a triathlon, your focus should move from performance to recovery. This involves:

- Refueling
- Repairing
- Rehydrating
- Revitalizing

Evidence-based strategies to enhance the recovery process should focus on:

- Energy balance
- Macronutrients
- Micronutrients
- Hydration
- Nutrient timing
- Supplements

ENERGY BALANCE

Energy (calories) is the foundation of the repair process. Optimize your energy by focussing on the 3 Ts:

1. **Total**- Match your caloric intake with your training/activity requirements and goals. Not eating enough stresses your

nervous system and adrenals and may delay the recovery process.

2. **Type**- Focus on carbohydrates for energy and glycogen restoration, adequate protein for repair and muscle protein synthesis, and healthy fats to minimize inflammation and support overall health.
3. **Timing**- Time your meals strategically around training sessions and competitions.

Energy availability is essential for performance and recovery. Energy availability is the difference between energy intake (diet) and energy expenditure (exercise, training and competing, and NEAT- non-exercise activity thermogenesis).

Low Energy Availability (LEA) occurs when there is an imbalance between the energy intake (calories from carbohydrates, proteins and fats) and energy expenditure, resulting in an energy deficit. Affecting both men and women, LEA can be inadvertent, intentional or psychopathological (e.g., disordered eating). It is a factor that can adversely impact reproductive, skeletal and immune health, training, performance and recovery, as well as a risk factor for both macro- and micronutrient deficiencies.

Are you at risk for LEA?

- Performing multiple training sessions daily/weekly
- Irregular eating patterns
- Failing to meet your energy needs
- Unrealistic/unsupervised calorie restriction to make your weight

Signs & Symptoms of Poor Energy Management

- Chronic fatigue
- Anemia/low serum iron
- Recurring infections and/or illnesses
- Depression and/or irritability
- Disordered eating
- Irregular menstrual cycles
- Inability to gain or build muscle or strength
- Recurrent injuries
- Training hard but not improving performance
- Poor performance
- Decreased muscle strength and power
- Poor healing/recovery

- Abnormal or unplanned weight loss
- Gastrointestinal problems
- Decreased bone mineral density
- Stress fractures

Practical Strategies to Meet Your Energy Needs

- Aim for three meals and snacks
- Adjust your intake based on your activity needs
- Supplement with additional snacks and protein shakes to meet the energy demands of your training, if necessary
- Develop realistic and health-minded performance and body composition goals
- Set realistic timelines for any weight loss or body composition changes
- Follow well-planned and personalized training and nutrition strategies that can best prepare you to perform and stay healthy

Determining Your Energy Needs

There are a number of online calculators that can help you estimate your Resting Metabolic Rate (RMR) and Activity Energy Expenditure to determine your Total Daily Energy Expenditure and optimum energy requirements.

http://www.bmi-calculator.net/bmr-calculator/

https://tdeecalculator.net/

Bottom Line- Meet your energy needs by matching your caloric intake with expenditure.

MACRONUTRIENTS

Macronutrients are both energy substrates and signaling molecules that can be strategically manipulated in order to ensure adequate recovery.

CARBOHYDRATES:

Carbohydrates (sugars, starches and fibers) are the primary energy source for moderate-intense activity. They can be categorized according to their glycemic effect.

High Glycemic (e.g., simple sugars)- rapid increase in blood glucose and insulin

Low Glycemic (e.g., complex fibrous foods)- slow increase in blood glucose

General Carbohydrate Guidelines:

Match needs based on activity:

- Low intensity/skill based: 3–5 g/kg BW
- Moderate intensity: 5–7 g/kg BW
- High intensity: 6–10 g/kg BW
- Extreme: 8–12 g/kg BW

Carbohydrates For Recovery

During postexercise recovery, optimal nutritional intake is important to replenish endogenous substrate stores and to facilitate muscle-damage repair and reconditioning. After exhaustive endurance-type exercise, muscle glycogen repletion forms the most important factor determining the time needed to recover.

The postexercise carbohydrate (CHO) recommendations is 1 g/kg/ BW hour for four hours, then match activity needs (see above). This is the most important determinant of muscle glycogen synthesis.

Since it is not always feasible to ingest such large amounts of CHO, the combined ingestion of a small amount of protein (0.2−0.4 g · kg−1 · hr−1) with less CHO (0.8 g · kg−1 · hr−1) stimulates endogenous insulin release and results in similar muscle glycogen-repletion rates as the ingestion of 1.2 g · kg−1 · hr−1CHO.

Additionally, postexercise protein and/or amino acid administration is warranted to stimulate muscle protein synthesis, inhibit protein breakdown, and allow net muscle protein accretion. The consumption of ~20 g intact protein, or an equivalent of ~9 g essential amino acids, has been reported to maximize muscle protein synthesis rates during the first hours of postexercise recovery.

Consuming CHO and protein (4:1) during the early phases of recovery has been shown to positively affect subsequent exercise performance and could be of specific benefit for athletes involved in multiple training or competition sessions on the same or consecutive days.

(Burke, L. M. 2015) (Smith-Ryan, A., & Antonio, J. 2013) (Beelen, M., et al. 2010)

Carbohydrate dosing relative to resistance training should be commensurate with intensity guidelines outlined under the carbohydrate section.

PROTEINS:

Large macromolecules of one or more long chains of amino acid residues.

Protein functions:

- Catalyzing metabolic reactions
- DNA replication
- Transporting molecules
- Muscle Protein Synthesis (MPS)
- Energy supply

Sources:

Complete (All essential amino acids)- Animal products: beef, poultry, pork, lamb, fish, eggs, dairy

Incomplete- Plant products (Quinoa and soy are complete proteins, but there is an energy trade off, i.e., more calories/serving to get the same amount of leucine)

Protein and Recovery

Optimum protein consumption is a key to minimizing catabolism, stimulating muscle protein synthesis and facilitating repair.

Protein Recovery Guidelines For Strength Training:

- Protein Dose: 1.6–2.0 g/kg BW
- 25–0.5 g/kg BW/meal in 4 divided meals
- Branch Chain Amino Acids- Leucine dose: 3 g is optimal to stimulate muscle protein synthesis (whey is a good source)
- The addition of 50 g of carbohydrate with protein pre- and post-exercise can decrease muscle breakdown
- Consuming 1–2 small protein rich meals in the first 3 hours post-exercise can capture the peak of muscle protein synthesis

(Dreyer, H. C., Drummond, et al. 2008) (Norton, L. E., & Layman, D. K. 2006) (Smith-Ryan, A., & Antonio, J. 2013) (Naderi, A. et al. 2016)

FATS:

Fats and oils are categorized according to the number and bonding of the carbon atoms in the aliphatic chain. The degree of saturation determines the melting point and stability.

Saturated fats - no double bonds. Solid at room temperature.

Unsaturated fats - one or more double bonds. Liquid at room temperature.

Functions:

- Energy source and energy storage
- Hormone production

Essential Fatty Acid Balance

The Standard American Diet (SAD) is notoriously pro-inflammatory, with the Omega 6:Omega 3 greater than 4:1 (closer to 18:1).

To reduce inflammation and enhance recovery, athletes should focus on getting the fats in their diet from dark green leafy vegetables, flax/hemp seeds, walnuts, cold water fish, grass-fed beef, omega-3 eggs; and limit omega-6 (vegetable and seed oils). Saturated fat should come from grass fed, pasture raised animals. Olive and avocado oils are good choices for cooking.

(Simopoulos, A. P. 2008)

Fish Oil for Repair and Recovery

DOSE: AHA recommends 1 g/day for general health. To reduce soreness: 6 g dose, spread over the course of a day.

(Smith-Ryan, A., & Antonio, J. 2013)

MICRONUTRIENTS AND PHYTONUTRIENTS

Micronutrients include vitamins and minerals. They are required in small quantities to ensure normal metabolism, growth and physical well-being.

If your diet is 50-75% plant-based and includes healthy fats and adequate protein, you are likely to get the vitamins, minerals and phytonutrients you need without having to rely on supplementation.

Phytonutrients

Phytonutrients, also called phytochemicals, are chemicals produced by plants. Phytonutrient-rich foods include colorful fruits and vegetables, legumes, nuts, tea, cocoa, whole grains and many spices. Phytonutrients can aid in the recovery process due to their anti-inflammatory properties.

Antioxidants- Too much of a good thing?

Reactive oxygen species (ROS) and reactive nitrogen species (RNS) are free radicals that are produced during exercise that can cause skeletal muscle damage, fatigue and impair recovery. However, ROS and RNS also signal cellular adaptation processes.

Many athletes attempt to combat the deleterious effects of ROS and RNS by ingesting antioxidant supplements (e.g., vitamins A, E, C, and the minerals Se and Zn).

Unfortunately, interfering with ROS/RNS signalling in skeletal muscle during acute exercise may blunt favourable adaptations and can attenuate endurance training-induced and ROS/RNS mediated enhancements in antioxidant capacity, mitochondrial biogenesis, cellular defence mechanisms and insulin sensitivity.

In addition, antioxidant supplementation can have deleterious effects on the response to overload stress and high-intensity training, thereby adversely affecting the remodelling of skeletal muscle following resistance and high-intensity exercise.

The bottom line is that physiological doses (from the diet) are beneficial whereas supraphysiological doses (supplements) during exercise training may be detrimental to one's gains

(Merry, T. L. and Ristow, M. 2016)

HYDRATION

Water regulates body temperature, lubricates joints and transport nutrients. Signs of dehydration can include fatigue, muscle cramps and dizziness.

During the recovery phase, staying hydrated can help stimulate blood flow to the muscles, which can reduce muscle pain. In addition, hydration can help flush out toxins which can exacerbate muscle soreness.

Are You Dehydrated?

Urine Color	**Meaning/Status***

Clear	Good hydration, overhydrated to mild dehydration
Pale Yellow	Good hydration or mild dehydration
Bright Yellow	Mild to moderate dehydration or possibly taking vitamin supplements
Orange, Amber	Moderate to severe dehydration
Tea / Apple Juice Colored	Severe dehydration

*Exceptions do exist- can be caused by medications, protein supplmentation, vitamins, food pigments and artificial colorings, etc.

Endurance Sports Considerations

- Early consumption of at least 150% of fluid lost with dilute sodium solution (</= 50 mmol/L, e.g., isotonic sports drink)
- Events greater than 90 minutes require pre-event hydration strategies 2–3 days prior (e.g., consume 400-600 mL of fluid every 2–3 hours containing Na 40–100 mmol/L)
- Aim to hydrate back to pre-race weight

(Smith-Ryan, A., & Antonio, J. 2013)

Homemade Electrolyte Recovery Drink

- 1/2 cup fresh orange juice
- 1/4 cup fresh lemon juice
- 2 cups raw coconut water
- 2 tbsp organic raw honey
- 1/8 tsp Himalayan pink salt

Blend ingredients and chill

NUTRIENT TIMING FOR RECOVERY

Timing your nutrition for recovery should include ensuring pre-exercise meal(s) adequately fuel your activity and that you optimise your macronutrients, as mentioned above, to maintain glycogen stores and protein balance. While there is some debate with respect to the post-exercise "optimum window," one should consider that it is likely that glycogen replenishment and protein consumption soon after exercise or an event can help optimize adaptations and recovery and minimize adrenal stress and catabolism.

SUPPLEMENTS FOR INJURY RECOVERY

Supplements can play a role, but the emphasis should be on, energy balance, macronutrients, micronutrients from whole foods and nutrient timing.

The following supplements can help with the recovery process:

Supplement	Mechanism	Dose	Other Considerations
Curcumin	Anti-inflammatory	500 mg 3x/day	Poor absorption: Needs to be compounded with piperidine or phosphatidy- choline
Ginger	Anti-inflammatory	1g ginger powder 3x/day	Add to food or take as a supplement
Watermelon Juice (L-Citrulline and Lycopene)	Decreases lactic acid Decreases muscle soreness- Anti-inflammatory	500 mL of juice daily. Start 5 days before event and 20 minutes before exercise	Include as part of diet when in season

Beetroot Juice (Nitrite)	Increases nitric oxide, which helps with blood flow. Effective for aerobic, anaerobic and strength sports	250 mL daily	Consume regularly during training or competition
Tart Cherry Juice	Antioxidant Anti-inflammatory	12 oz 2x/day for 8 consecutive days prior to event	
Chocolate Milk	Glycogen Resynthesis Protein source Rehydration	16 oz	Post-exercise recovery

Collagen Peptides	Supports fibroblast and connective tissue for soft tissue and bone health	2 scoops in 8 oz water or juice twice daily	Choose product that is from grass fed/pasture raised sources
Vitamin C	Connective tissue repair Collagen production Antioxidant	500 mg-1 g daily	Watch bowel tolerance with higher doses

(Black, C. D. et al. 2010) (Connolly, D. A. J. et al. 2006) (Davis, J. M. et al. 2007) (Saunders, M. J. 2011) (Smith-Ryan, A., & Antonio, J. 2013) (Tarazona-Díaz, M. P. 2013)

Summary of Key Points

- Focus on: Energy balance, macronutrients, micronutrients, nutrient timing, supplements
- Consider the 3 T's- Total/Type/Timing
- JERF- Just Eat Real (and a Rainbow of) Food
- Keep hydrated
- Choose evidence-based supplements

Recovery smoothie (makes about 2 servings)

- 1 cup water
- 1 cup kale or spinach
- 1 peeled beet
- ½ cup frozen organic berries
- 1 banana
- ½ avocado
- ½ tsp raw cacao

Blend ingredients and enjoy!

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