Sports Nutrition Keys for Optimal Performance

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Performance Nutrition Keys

- Eat adequate energy to enhance performance and maintain lean body mass
- Go into workouts and competitions with optimal nutrition and hydration
- Fuel workouts appropriately
- Refuel after workouts and competitions
- Optimize iron and calcium
- Utilize additional supplementation appropriately and optimally

Energy needs

Basic caloric requirement:

Calorie Needs Depend On:

Lean Muscle Mass

Length and Intensity of Workouts

Physical and Sport Goals

- Depending on the body size, fitness level, and the sport, energy needs will vary widely
- Examples of estimated calories burned/lb/min

	140-lb	180-lb
Basketball:	9.4	12.1
Football:	8.4	10.8
Soccer:	8.7	11.1
Volleyball:	9.3	12.0

McArdle, Katch, and Katch, Sports & Exercise Nutrition, 1999, 589-601

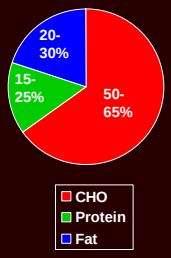
Estimated Daily Energy (Calorie) Needs for Training

Training/workouts Calories/#	120#	160#	280#
Low (sedentary) 13 to 15	1,560 – 1,800	2,080 – 2,400	3,640 – 4,200
Active (30 to 60min/d) 16 to 18	1,920 – 2,160	2,560 – 2,880	4,480 – 5,040
Moderate (1 to 1 ½ hr/d) 19 to 21	2,280 – 2,520	3,040 – 3,360	5,320 – 5,880
High (1 ½ to 2 hr/d) 22 to 24	2,640 – 2,880	3,520 – 3,840	6,160 – 6,720
Very High (2 to 3 hours/d) 25 to 30 or more	3,000 – 3,600	4,000 – 4,800	7,000 – 8,400

Macronutrient Keys

- **CARBOHYDRATES are KEY** for MAXIMAL energy, speed, stamina, concentration, recovery and better fluid balance
- **BOTH carbohydrate and protein** are important for muscle strength and mass
- **FAT** needs to be part of the plan for stamina

Macronutrient Needs



Carbohydrate & protein needs may be better expressed as *absolute grams* rather than as % of kcals.

Carbohydrates Fuel Muscles

***A muscle is like a sponge**

***Keep your muscles full of fuel**

***Carbs reach muscles quickly**

***Goal: 50-65% carbohydrate**

Carbohydrates…FUEL

- **Carbohydrate Needs:**

30 min – 1 hr moderate exercise: 4-6g/kg (1.8-2.7g/#)
1 hr intense training/day: 7g/kg (3g/#)
1-2 hrs intense training/day: 8-9g/kg (3.5-4g/#)
2-4 hrs intense training/day: 9-10g/kg (4-4.5g/#)
Ultraendurance athletes: >12g/kg (5.5g/#)

150-lb active woman: 3x/week spinning class: 300g carbs/day

150-lb Lance Armstrong: 800g carbs/day

Restricted Carbohydrates → Disordered Eating???

- **"I'm good if I don't eat too many carbohydrates"**
- **"If I eat carbohydrates, they'll be stored as fat"**
- **"My energy is low, but I want to stick to 100 grams of carbohydrate"**
- **"I try not to eat carbohydrates after 6pm" (workout from 3-5 pm)**
- **"I can't seem to stop eating carbs if I let myself get started"**

Carbohydrate in foods

Food	CHO content
1 cup Gatorade	14
Apple	20
Banana	25
1 cup orange juice	25
1 cup Sprite	26
2 sl. bread	30
1 cup spaghetti	40
1 cup rice	42
1 baked potato	50
1 cup fruit yogurt	50
2 cups fruit punch	74

Carbohydrates: Practical Issues

- Carbohydrate-loading really works
  - "Glycogen Supercompensation"
  - 3 days out…100-150 extra grams CHO + ↓exercise
  - Add 30-40 ounces 100% juice daily
- Athletes benefit from carbohydrates during intense exercise (↑physical & mental performance, ↓fatigue)
  - 30-60grams/hour recommended
- Consider pre-event, half-time and during-event carbohydrate options

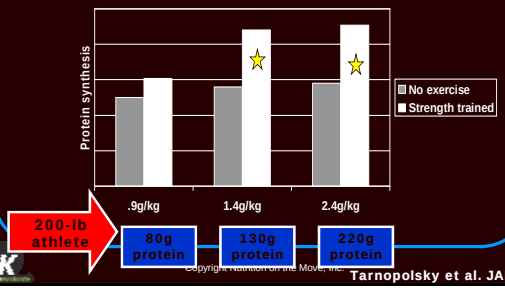
Protein for tissue and muscle building and repair

Protein needs: 1.2 to 1.7 g/kg (0.5 – 0.8 g/#)

- Protein intake and timing of protein intake are both important for increasing lean muscle mass
- Eating protein several times during the day may enhance available amino acids during workouts
- Going into strength workouts nourished may enhance strength gains and decrease net protein losses
- Refueling immediately after workouts with a carbohydrate/protein mix is essential for enhancing strength gains

How much is too much?

- Though controversial, there appears to be a CEILING for protein intake and muscle building



Tarnopolsky et al. JAP, 1992

Food	Grams of Protein
2 chicken breast halves (10 oz.)	85 grams
8 oz. lean sirloin steak	68 grams
8 oz. salmon	58 grams
½ cup tuna salad	33 grams
4 oz. turkey slices	25 grams
2 cups milk	16 grams
4 egg whites	16 grams
2 large eggs	14 grams
1 cup beans	14 grams
1 cup yogurt	10 grams
2 tablespoons peanut butter	8 grams

Meet Tony

- Division 1 Football player
- 6'5" 250#
- Trouble with recovery from workouts (low energy) and gaining lean muscle
- Nutrition issue: Protein, protein, protein

Current Intake for Tony

Energy	4,500 calories
CHO	260 g/day (23%) 1.0 g/lb/day
Protein	550 g/day (49% of calories) 2.2 g/lb/day
Fat	140 g (28%) Food + extra oils
Post-exercise CHO	Limited carbohydrate – 80-gram protein shake right after workouts

Macronutrient Needs for Tony

Energy	5,000 – 5,500 (REE X 1.5) + 1,500 – 2,000 for workouts
CHO	750-825 g/day (60%) 3.0 – 3.5 g/lb/day
Protein	250 g/day (20%) 1.0 g/lb/day
Fat	100 - 120 g (20%) 20% of calories
Post-exercise CHO	At least 125g CHO + 40g PRO within 15 minutes

Myth: When it comes to fat, less is best
Fact: Cutting fat too low can compromise performance, immunity, and health

- Some athletes compromise poor performance because of very low fat intake
- Fat is an important energy source for athletes
- Fat is an important carrier of vitamins and precursor to hormones
- Fat can aid athletes in decreasing inflammation and enhancing repair after injuries
- Choosing quality fats is key for athletes

Fat intake: 20-30% (not <15%)

- **Optimal fat:** 20-30% of calories
- Moderate fat diet aids overall health, minimizes GI upset, and allows for adequate CHO and PRO intake
- Include more nuts, seeds, nut butter, soybeans, unsaturated oils (olive, canola, avocado, flaxseed)
- Add more tuna, salmon, and fish oils
- Choose low-fat vs. nonfat products for needed energy and fat
- "Fat Phobia" may be a sign of disordered eating

Pre-exercise Fuel

Pre-exercise fuel should:

- ✓ **Provide energy to working muscles**
- ✓ **Maximize blood sugar and glycogen stores**
- ✓ **Provide a psychological edge**
- ✓ **Minimize hunger during play**
- ✓ **Provide ample carbohydrates with moderate protein and fat**
- ✓ **Consist of foods an athlete is used to and relies on in training**
- ✓ **Be individualized based on an athlete's needs**
- ✓ **Maximize hydration**

Pre-Exercise Fuel

- Eat a pre-workout meal 2-3 hours (small meal) to 4 hours (moderate size meal) before workouts and competitions
- Eat a meal high in carbs
- Drink extra fluids – no caffeine or carbonated beverages
- As a general rule, eat a meal that's 2/3 "normal" size
- Eat foods you are used to and like to eat

High-Energy Food

Plan quick snacks closer to workouts and competitions

- **Granola bars**
- **Energy bars**
- **Bananas**
- **Grapes**
- **Applesauce**
- **100% juices**
- **Cereal**
- **Bagels**
- **Yogurt**
- **Sports drinks**

WHAT TO EAT

Meal composition should be:

- **2/3 carbohydrate foods**
  - **Bread, bagels, pasta, rice, cereal**
  - **Fruits/juices, vegetables**
  - **Yogurt, milk**
- **1/3 protein**
  - **Lean red meats, poultry, fish, shellfish, eggs, milk, cheese, soy products, beans, nuts, nut butters, seeds**

Fueling During Exercise

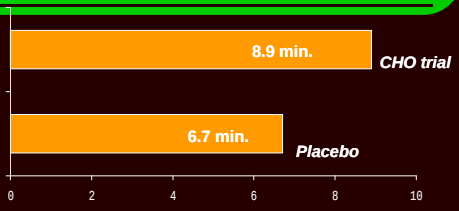
- Aim for at least 30-60 grams CHO/hour
- A mixture of two or three different carbohydrate sources enhances carbohydrate oxidation – providing more muscle energy
- Solid carbohydrates may be equally as useful as liquid sources if well-tolerated (i.e. cycling, hiking)
- Multiple events or competitions:
  - If >2 hours between competitions, both PRO and CHO
  - If <2 hours between competitions, mostly CHO

Stop and Go Sports

- One week apart, 9 male players completed 75 minutes of shuttle runs followed by intermittent running to fatigue (performance trial).
- These intermittent, high-intensity shuttle runs were designed to replicate activity patterns of stop and go sports. They consisted of intermittent running, including maximal sprinting interspersed with less intense periods of running and walking.
- The athletes drank either a 6.9% carbohydrate-electrolyte drink or placebo immediately prior to exercise (5 ml per kg) and every 15 minutes thereafter (2 ml/kg).

Nicholas et al., *J Sports Sci.* 1995; 13(4):283-290

RESULTS: Shuttle Run Test

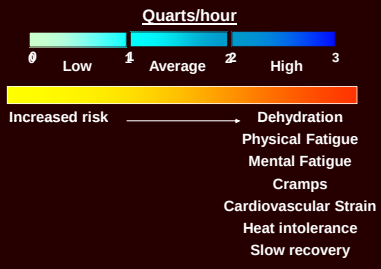


Time of Exercise to Fatigue

- **Conclusion:** A carbohydrate-electrolyte drink improved performance during intermittent, high-intensity exercise.

Nicholas et al. *J Sports Sci.* 1995; 13(4):283-290

Sweat Loss = Dehydration = Fatigue



Daily sweat loss in athletes: **1 to 12 quarts/day!**

Dehydration Impairs Attentiveness in Basketball Players

- 11 male players
- Dehydrated to 1%, 2%, 3%, or 4%
- As dehydration progressed, the players exhibited slowed response time and inattentiveness to cues (computer-based testing)
- The authors determined these differences in response would likely lead to costly errors in a basketball game

Med. Sci. Sports Exerc. 2007 39:976-983

FLUIDS - HOW MUCH?

- **Basic fluid guidelines**
  - **16-20 ounces (2+ cups) 2 hours BEFORE practices + at least 8 ounces 10-20 minutes prior**
  - **6-8 ounces ounces every 15-20 minutes DURING practices (preferably sports drink)**
  - **16-24 ounces (2-3 cups) for every pound lost within 2 hours AFTER practices and competitions**

FLUID REPLACEMENT TIPS

- Hydrate **BEFORE** workouts
- Periodically assess weights before and after workouts
- Drink 2-3 cups per pound lost in a workout. Start early and preferably drink fluids with carbohydrates and electrolytes
- Encourage high-fluid foods (fruits, yogurt, soups, smoothies)
- Use more salt (1g/Liter average losses)
- Check your urine!
  - Light in color & lots

Apple Juice (dehydrated) Lemonade (hydrated)

Football Lineman

- 280# Defensive Lineman
- Severe cramping during pre-season
- Heavy sweater – typical losses in pre-season practices: 8-10# or 2.8 – 3.6% of body weight.
- Pre-workout fuel: limited due to stomach distress.
- Normal blood pressure, but high blood pressure in the family = low salt diet was norm at home and didn't like to salt food.

Football Lineman

- Sweat sodium losses estimated at 1,000 mg per Liter (4,000 to 5,000 mg per workout).
- Solutions:
  - More liquid carbohydrates pre-workout.
  - Utilize Gatorade Endurance (200mg sodium/8 ounces) pre-workout and during workouts.
  - Boost current fluids to 12 ounces every 15 minutes of hard workouts (double current intake).
  - Salt food after workouts and at evening meal.
  - 2 Gatorade Endurance bottles 1-2 hours before bed to pre-hydrate for AM workouts.
  - RESULT: 3-4# loss consistently and no cramping.

Recovery Nutrition

(for intense, dehydrating exercise)

- **Fluids**
  - 24 ounces for every pound lost during exercise within 2 hours
  - Need 150% of fluid loss to compensate for urine production
  - Achieve body weight within 1% of "start weight" before next session
  - Include sodium
- **Carbohydrates**
  - .5 grams/kg body weight within 30 minutes
  - TOTAL of 1.5 grams/kg body weight within 2 hours
  - High glycemic index preferred
- **Protein**
  - 10-20 grams protein within 30 minutes
  - Does protein source matter?

Recovery Options

- Food and fluids
- Sports foods & drinks
  - Readily available
  - Easily transported and stored
  - Can be a daily program
- Just eat within 30 minutes of your workout!

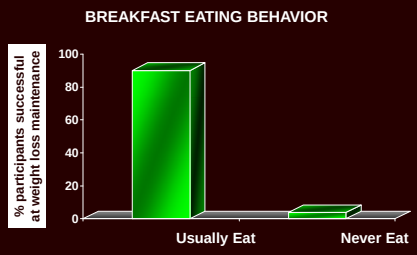
Weight Loss…Practical Issues

- Don't lose it too fast!
- Fad diets can have risky consequences
- Use sound nutrition plans with balance, variety, and sensible eating
- No more than 2 pounds/week
- Utilize body composition measurements
- Do not jeopardize energy level for training
- Should take place during off-season

Weight Loss Strategies

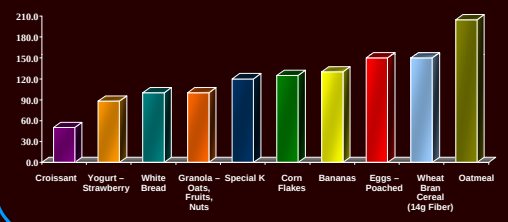
- Space out meals and snacks throughout the day, including a sound breakfast
- Maintain protein intake while dropping carbohydrate and protein slightly
- Increase fiber
- Know that liquids add calories too!
- Increase workouts if appropriate
- Track food logs

Eating Breakfast Is Important for Successful Long-Term Weight Loss



N = 2,959 men and women from the National Weight Control Registry
Kept weight off (30 lbs) for at least one year
Source: Wyatt H et al. Obesity Res 2002; 10:78-82.

Satiety Index of Breakfast Foods



Source: Holt et al. European Journal Clinical Nutrition 1995, 49:675-690.

How to Get Leaner

1. Eat regular meals, preferably 5-6 times per day. Each time you eat, your body goes into a calorie-burning mode, and metabolism bumps up.
2. Shoot for a balanced plate:
   1/3 protein, 1/3 grain, 1/3 fruit and veggie
3. Keep your calcium intake up. Calcium may facilitate fat burning with weight loss. Get at least 4 servings (1 cup milk or yogurt = 1) per day. If lactose is a problem, consider a calcium supplement.
4. Cut down on extra fried foods and sweets. Just by eliminating two donuts a day, that equates to at least a pound of fat lost in one week.

How to Get Leaner

5. Keep tabs on what you're drinking:

   *24 ounces (3 glasses) of regular soda, juice, or juice drink gives you an extra 350 – 400 calories a day, or an extra 3# in a month!

   *Be smart about alcohol: when you drink alcohol, your body slows down the digestion of food in your system, and this can promote weight gain.

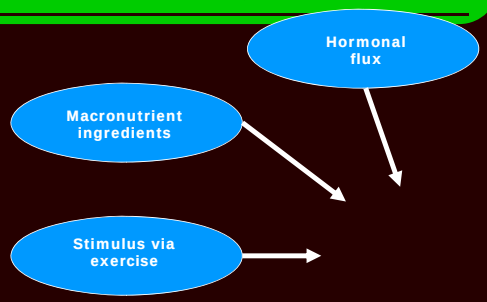
More on alcohol

*Alcohol reduces concentration, coordination, and response time and interfere with normal sleeping.

*Alcohol has a diuretic effect, and also promotes water loss. So, if you work out the day after drinking, you'll be extra dehydrated, and at risk for injury or heat illness

*Plus, alcohol is very caloric:
- *4, 12-ounce rum and cokes = 1,000 calories
- *4, 16-ounce regular beers = 800 calories
- *4, 12-ounce wine coolers = 720 calories
- *4, 16-ounce lite beers = 550 calories

Gaining Lean Body Mass



Strategies for Increasing Lean Body Mass

- Increase caloric intake by 1,000 to 1,500/day
- Emphasize BALANCE of nutrients
  - More carbs, protein, and fat
- Maximize protein (up to 2 g/kg)
- Eat 5-6 times a day
- Boost pre-workout and post-workout fuel
- Focus on weekend eating, too

Maximize creatine in foods

Food	Grams Creatine
8 ounces pork:	1.1
8 ounces salmon:	1.0
8 ounces beef:	1.0
8 ounces cod:	0.7

Supplemental Creatine Dose: 3-5 grams/day

Incidence of Iron Deficiency & Anemia

- Typically thought to be higher in females and endurance athletes
- BUT in a study of 100 high-level basketball players,
  - Iron deficiency (Hgb <12 g/dl) was found in 37% of females and 14% of males.
  - Full iron deficiency anemia was noted in 14% of females and 3% of males.

Dubnov and Constantini, Int. J. Sport Nutr. Exerc Metab. 14:30-37, 2004.

Iron Deficiency and Anemia

- Roughly 30% of female athletes are low in iron
- *Low iron = low energy in workouts*
- Some foods/meds decrease or increase iron absorption
  - **Blockers -** tea, coffee, calcium, antacids (ex. Tums), H2 blockers (ex. Zantac), Proton Pump Inhibitors (ex. Prilosec)
- Eat more:
  - Red meat, chicken, turkey, fish, and eggs
  - Beans, peas, nuts, peanut butter
  - Spinach, greens, raisins, 100% iron fortified cereals
  - Vitamin C (citrus, broccoli, tomatoes, OJ)

Stress Fractures

- What is a stress fracture?
  - A skeletal defect that results from repeated application of stress that is less than that required to fracture a bone in a single loading, but greater than the bone's ability to recover fully.
- Stress Fracture Commonalities:
  - 15% of female athletes in 5 year period at one DI university
  - 95% of all stress fractures occur in the lower extremities
  - A study of 5,900 college athletes revealed no significant difference between male and female susceptibility to stress factors. However, when looking specifically at track and field athletes, women's incidence for stress fracture's was nearly doubled.

Feingold et al. Female athlete triad and stress fractures. Orthop Clin North Am. 2006 Oct;37(4):575-83.

Calcium Needs for Athletes

Age (years)	Calcium DRI (mg)
14-18	1300
19-30	1000
31-50	1200
>50	1200

- GOAL: 1,500 mg-2,000 mg/day especially for females, amenorrheic, high sweat loss (some calcium is lost in sweat)
- Don't drink milk? Try CIB, soy milk, yogurt, cheese, calcium-fortified cereals, breads, mac and cheese, and juices

Some Supplement Promises...

***Increase power** ***Increase endurance**

***Gain muscle** ***Burn fat**

***Increase speed** ***Help to relax**

***Take the place of food** ***Achieve goals faster**

Most commonly used supplement categories

- Anabolics or muscle builders
- Weight loss or fat loss supplements
- Energy boosters
- Herbs
- Vitamin-mineral supplements

Questions to ask regarding supplements

1. **Is the supplement legal?**
2. **Is the supplement safe?**
3. **Is the supplement backed in solid research?**
4. **Is the company reputable?**
5. **What is the risk/benefit of taking the supplement?**
6. **Is the athlete doing everything possible with his or her diet FIRST before relying on a supplement?**

Supplement Watch

***Energy Drinks**
***High-dose Caffeine**
***NO Supplements**
***Pre-Anabolics**
******Natural*** **Supplements**

Antioxidants

- Antioxidants help protect the body from harmful free radicals.
- Free radicals can damage tissues, cells, and genes. They occur in the environment and are naturally produced by the body.
  - A natural type of "rusting"
- Antioxidants neutralize free radicals before damage to cells and tissue occurs.

Colors	Fruits and Veggies
Green	Broccoli, Brussels Sprouts, Bok Choy, Cauliflower, Cabbage, Kale, Collards, Mustard Greens, Green Peppers, Kiwi, Spinach, Limes, Leeks, Avocados
Orange/Yellow	Oranges, Tangerines, Yellow Grapefruit, Peaches, Lemons, Papaya, Pineapple, Nectarines
Red/Purple	Red Grapes, Purple Grape Juice, Cherries, Berries, Plums, Prunes, Raisins
White	Onions, Chives, Garlic

Supplements that may offer potential benefit

1. 100% multivitamin/minerals (with iron for females and males with a history of low iron).
2. Calcium/vitamin D supplements if calcium is low in the diet or athletes are lactose intolerant – preferably with magnesium and Vitamin K.
3. Additional iron if anemic.
4. Sports drinks during workouts.
5. Recovery shakes for post-workout.
6. Glucosamine / chondroitin / fish oils for chronic joint pain / arthritis.
7. Herbal cold preparations (echinacea, astragalus, elder berry).
8. Caffeine in trusted and tolerated amounts.
9. Additional Vitamin C (500-1,000 mg per day).
10. Creatine (food first) if appropriate (3g/day).

Sports Nutrition Resources

RK Team Nutrition: www.rkteamnutrition.net

Nutrition on the Move: www.nutritiononthemove.net

Gatorade Sports Science Institute website: www.gssiweb.com

SCAN: www.scandpg.org