Sports Nutrition
for the athlete in all of us...

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Duke University
What Would We Like to Achieve?

eat food. mostly vegetables. not too much. Michael Pollan

A foundational understanding of nutrition for health and performance

- The body is a unit, the person is a unit of body, mind, and spirit.
- The body is capable of self-regulation, self-healing, and health maintenance.
- Structure and function are reciprocally interrelated.
- Rational treatment is based upon an understanding of the basic principles of body unity, self-regulation, and the interrelationship of structure and function.
1. The body is a unit; the person is a unit of body, mind, and spirit.

2. The body is capable of self-regulation, self-healing, and health maintenance.

3. Structure and function are reciprocally interrelated.

4. Rational treatment is based upon an understanding of the basic principles of body unity, self-regulation, and the interrelationship of structure and function.
The overall body of evidence identifies that a healthy dietary pattern is higher in vegetables, fruits, whole grains, low- or non-fat dairy, seafood, legumes, and nuts; moderate in alcohol (among adults); lower in red and processed meats; and low in sugar-sweetened foods and drinks and refined grains.

Additional strong evidence shows that it is not necessary to eliminate food groups or conform to a single dietary pattern to achieve healthy dietary patterns. Rather, individuals can combine foods in a variety of flexible ways to achieve healthy dietary patterns, and these strategies should be tailored to meet the individual’s health needs, dietary preferences and cultural traditions.

Current research also strongly demonstrates that regular physical activity promotes health and reduces chronic disease risk.
Macronutrients...

[Diagram with annotations]
"Diets"

Paleo: eat tons of meat, no grains, EAT MORE VEGETABLES

Mediterranean: EAT MORE VEGETABLES with olive oil, fish, and some wine

LCHF: limit carbs, don’t fear fat, EAT MORE VEGETABLES

Low-Fat: high carbs, low fat foods (full of sugar), EAT MORE VEGETABLES

IFFYM: Eat whole foods, and whatever else you want.. peanut M & Ms anyone?
Protein

Fed State
- Amino acids travel to liver
- Liver uses amino acids for protein synthesis
- Excess converted to glucose or fatty acids
- Stored as glycogen or in adipose tissue
- Excess amino acids can also be sent to muscle for protein synthesis

Fasted State
- Amino acids sent to liver from muscles
- Converted to glucose
- Used for energy

<table>
<thead>
<tr>
<th>Group</th>
<th>Protein intake (g/kg/day)</th>
<th>Protein intake (g/lb/day)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sedentary Individual</td>
<td>0.75</td>
<td>0.34</td>
</tr>
<tr>
<td>Elite endurance athletes</td>
<td>1.2-2.0</td>
<td>0.54 - 0.90</td>
</tr>
<tr>
<td>Moderate-intensity endurance athletes (a)</td>
<td>1.2</td>
<td>0.54</td>
</tr>
<tr>
<td>Recreational endurance athletes (b)</td>
<td>0.8-1.0</td>
<td>0.36-0.45</td>
</tr>
<tr>
<td>Team sports/power sports</td>
<td>1.4-1.7</td>
<td>0.63-0.77</td>
</tr>
<tr>
<td>Strength/resistance athlete</td>
<td>1.5-2.0</td>
<td>0.68-0.90</td>
</tr>
<tr>
<td>Athlete on fat-loss programme</td>
<td>1.6-2.0</td>
<td>0.72-0.90</td>
</tr>
<tr>
<td>Athlete on weight-gain programme</td>
<td>1.8-2.0</td>
<td>0.81-0.90</td>
</tr>
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</table>

Too Much Protein?
- No advantage for performance
- Recommended protein intakes (up to 2g/kg/day) are not harmful in healthy individuals
- Once needs are met additional protein will not be converted to muscle
- Drink plenty of water to avoid dehydration
- Increased risk of osteoporosis through calcium excretion?
  - Largely unfounded
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Carbohydrates

- main fuel source for energy
- How many grams of carbs you can afford will be determined by:
  - levels of muscle mass,
  - volume and intensity of training,
  - percentage of body insulin sensitivity
  - Level of exercise training
  - Initial muscle glycogen levels
  - Age

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**Carbohydrate Targets**

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<thead>
<tr>
<th>Carbohydrate Target</th>
<th>Target Amount</th>
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<tr>
<td>3-5 g per kg BW</td>
<td>1.36-2.27g per lb BW</td>
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<td>5-7 g per kg BW</td>
<td>2.27-3.18g per lb BW</td>
</tr>
<tr>
<td>7-12 g per kg BW</td>
<td>3.18-5.45g per lb BW</td>
</tr>
<tr>
<td>10-12 g per kg BW</td>
<td>4.54-5.45g per lb BW</td>
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**Glycemic Index**

- [Graph showing blood sugar levels and glycemic index over time]
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Glycemic Index

Blood sugar response 1:
- Sugary foods

Remaining blood sugar from previous meal

Blood sugar response 2:
- Refined (white) carbs

Healthy blood sugar range

Blood sugar response 3:
- Whole grains
- Fruits & veggies
- Legumes

You eat a meal
30-60 min later
1-2 hours later
3-4 hours later
Fats

- Carbohydrates and fat are the main sources of fuel for exercise.
- Fat is stored in: adipose tissue and intramuscular.
- Adipose tissue:
  - muscle fuel equal to about 70,000+ stored calories.
- Intramuscularly:
  - 1,500 calories stored within muscle cells.
- Fatty Acids provide more ATP per molecules.
- Body can’t burn fats as fast as carbohydrates.
- No RDA set for total fat intake.
- Focus is on hitting CHO and PRO targets.
- Fat then makes up remaining calorie balance.
- Consumption of fat should not fall below 15% of total energy intake.

Restricting fat may impair performance.

Aim for a fat intake between 20-35% of calories.
Nutrient Timing

Pre-Workout

Carbohydrate Loading
- Exercise is high-intensity endurance activity where heavy demands are placed on glycogen stores
- Activity is likely to involve >90 minutes of continuous exercise
- You regularly eat less than 7-8g of CHO/kg of body weight per day

During Exercise
- 30g-90g CHO depending on length of event
- Protein not needed
- Fat as fuel?
  - cannot utilize as fast as CHO
  - new research into “fat burning” for endurance events

Post-Workout
- Combining CHO and protein
  - enhanced recovery
  - Enhances protein and CHO intake into muscle cells
  - High uptake of amino acids
- Aim for a 3:1 ratio
Carbohydrate Loading

- Exercise is high-intensity endurance activity where heavy demands are placed on glycogen stores
- Activity is likely to involve >90 minutes of continuous exercise
- You regularly eat less than 7-8g of CHO/kg of body weight per day
Carbohydrate Loading is NOT needed when:

- The exercise is not an endurance activity and normal glycogen stores will be adequate to fuel event
- Event will last <60-80 minutes
- The activity is high-intensity for a short duration and will be negatively affected by the weight gain associated with loading
- 30g-90g CHO depending on length of event
- Protein not needed
- Fat as fuel?
  - cannot utilize as fast as CHO
  - new research into "fat burning" for endurance events
• Combining CHO and protein
• Enhanced recovery
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Macronutrients in Real Life

"Your body is still counting macros...even if you are not" Michael Vacanti

- 1 gram of Protein = 4 calories
- 1 gram of Carbohydrate = 4 calories
- 1 gram of Fat = 9 calories
- 1 gram of Alcohol = 7 calories

Calculate Your Protein
- 0.8-1.5 g/lb BW
- 180g (x4) = 720 cals

Calculate Your Fat
- 180x0.3 = 54g (x9) = 486 cals

Carbs are what’s left
- 2200 - 720 - 486 = 994 cals (248g)

Calculate your “BMR” BW (lbs x 15)
- Fat Loss: - 500 cals
- Gain: + 500 cals
- 180lbs x 15 = 2,700 cals (2,200)
Equals and Aftermath
Intermittent Fasting

What is it? an “eating pattern” (not diet) of fasting between periods of eating

- The 16/8 Method: Fast for 16 hours each day, for example by only eating between noon and 8pm.
- Eat-Stop-Eat: Once or twice a week, don’t eat anything from dinner one day, until dinner the next day (a 24 hour fast).
- The 5:2 Diet: During 2 days of the week, eat only about 500-600 calories.
- The key is people still eat good food with these methods
Hydration

- Athlete needs = 1 ml per kcal consumed
  - 2500 cal = 2500 ml
  - 2500/240 = 10.5 cups/day

- Pre-Exercise
  - 5-7ml/kg or 2-3ml/lb within 4 hours
  - 170 lb = 500ml (16-20oz)
  - may add electrolytes if needed

- During Exercise
  - aim is to prevent >2% BW loss
  - add Na^+ for endurance events
  - consider CHO drinks for endurance events (<8% CHO)
  - You should never gain weight

- Post-Exercise
  - replace Na^+ and CHO losses
  - weigh yourself pre- and post- to know how much needed to replace losses
Intravenous Fluid Administration in Competition

Pregame IVF in the NFL

- 24 of 32 teams used pre-game IVF
- 5-7 players per game
- 1.5L 2.5 hours prior to game
- 23/24 “cramping”
- 10/24 player request
- Of those that didn’t use them
  - felt athletes wouldn’t orally hydrate as well
  - education
- 48% had complication
  - most common superficial thrombosis

Clin J Sport Med 2018;24:192-199

NCAA Football Pre-game IVF Use

- 77/120 teams responded
- 2-3 players per team
  - cramps, heat illness, dehydration
  - improve exercise tolerance and player request
- 24% with complications
  - superficial venous thrombosis
  - only 13% it helped their team performance
  - reasons why they didn’t give them
    - medical staff felt it didn’t help
    - previous complication
    - ATC never considered it

Clin J Sport Med 2013;31:98-100

What About During or Post-Competition?

- no good evidence to support IVF vs oral hydration
- more complications with IVF
- some studies state may be beneficial in high level athletes with close monitoring
- Use with heat illness (with cooling) or >1% dehydration
- Also consider in athletes with total body cramping, failed oral re-hydration, or with emesis
- We have used with athletes recovering from acute GI illness prior to game (not discussed in NFL or NCAA studies)
- Plasma expanders (glycerol etc.) have no role and are banned by WADA
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- only 15% it helped their team performance
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What About During or Post-Competition?

- No good evidence to support IVF vs oral hydration
  - More complications with IVF
- Some studies state may be beneficial in high level athletes with close monitoring
- Use with heat illness (with cooling) or >7% dehydration
- Also consider in athletes with total body cramping, failed oral re-hydration, or with emesis
- We have used with athletes recovering from acute GI illness prior to game (not discussed in NFL or NCAA studies)
- Plasma expanders (glycerol etc.) have no role and are banned by WADA
Nutrition for Injury Recovery
Kim Stein, GSSI

Managing Inflammation
- increase Omega-3 fatty acids from food not supplementation
- decrease Omega-6 fatty acids
- antioxidant supplementation not supported by research for anti-inflammation

Bone Healing
- calcium 1000mg/daily
- vitamin D 600 IU/d
- one study found that low vitamin D may hinder strength recovery

Calorie Needs to Promote Healing
- resting energy expenditure may increase up to 20% in injured athlete
- use of crutches may increase energy expenditure 2-3x
- need adequate calories to heal

Attenuate Muscle Loss
- immobilization associated with decreased muscle protein synthesis
- may need increased protein intake to support muscle growth
- meat and dairy protein contain leucine (signal to initiate protein synthesis)
- minimize alcohol use
Managing Inflammation

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- minimize alcohol use
Supplements

Are they needed for success?

Protein
- Not necessary
- Can help meet protein goals
- Consistent
- Easy to quickly absorb, good post-workout
- Lower glycemic index
- Eggs
- Plant-based (soy, etc.)

BCAA's
- Branched Chain Amino Acids
- Valine, leucine, isoleucine
- Safe
- Shown to stimulate protein synthesis and delay fatigue
- Expensive
- If used prior to workout may help to spare protein use for energy
Questions to Ask When Considering a Supplement

- Does the claim make sense?
- Is it supported by strong scientific evidence?
- Is it safe and legal?

AIS: Australian Institute for Sport
- excellent site for athlete education
- supplement classification ABCD
  - fact sheets
  - research summaries
## Group A

<table>
<thead>
<tr>
<th>Overview of category</th>
<th>Sub-categories</th>
<th>Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>Evidence level:</td>
<td><strong>Sports foods</strong> – specialised products used to provide a practical source of nutrients when it is impractical to consume everyday foods.</td>
<td>Sports drink, Sports gel, Sports confectionery, Liquid meal, Whey protein, Sports bar, Electrolyte replacement</td>
</tr>
<tr>
<td>Use within supplement programs:</td>
<td><strong>Medical supplements</strong> – used to treat clinical issues, including diagnosed nutrient deficiencies. Requires individual dispensing and supervision by appropriate sports medicine/science practitioner</td>
<td>Iron supplement, Calcium supplement, Multivitamin/mineral, Vitamin D, Probiotics (gut/immune)</td>
</tr>
<tr>
<td>Provided or permitted for use by some athletes according to best practice protocols.</td>
<td><strong>Performance supplements</strong> – used to directly contribute to optimal performance. Should be used in individualised protocols under the direction of an appropriate sports medicine/science practitioner. While there may be a general evidence base for these products, additional research may often be required to fine-tune protocols for individualised and event-specific use.</td>
<td>Caffeine, B-alanine, Bicarbonate, Beetroot juice, Creatine</td>
</tr>
</tbody>
</table>
# Group B

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<thead>
<tr>
<th>Overview of category</th>
<th>Sub-categories</th>
<th>Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>Evidence level:</td>
<td><strong>Food polyphenols</strong> – food chemicals which have purported bioactivity, including antioxidant and anti-inflammatory activity. May be consumed in food form or as isolated chemical.</td>
<td>Quercetin, Tart cherry juice, Exotic berries (açaí, goji etc.), Curcumin</td>
</tr>
<tr>
<td>Use within supplement programs:</td>
<td>Provided to athletes within research or clinical monitoring situations.</td>
<td>Anti-oxidants C and E, Carnitine, HMB, Glutamine, Fish oils, Glucosamine</td>
</tr>
<tr>
<td>Other</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
## Group C

<table>
<thead>
<tr>
<th>Overview of category</th>
<th>Sub-categories</th>
<th>Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>Evidence level: very little meaningful evidence of beneficial effects.</td>
<td>Category A and B products used outside approved protocols.</td>
<td>See list for Category A and B products.</td>
</tr>
<tr>
<td>No supplements provided to athletes in supplement programs.</td>
<td>The rest – if you can’t find an ingredient or product in Groups A, B or D, it probably deserves to be here.</td>
<td>Fact sheets and research summaries on some supplements of interest that do not belong in Group C may be found via the ‘A-Z of Supplements’ page in the AIS Sports Nutrition section of the ASC website.</td>
</tr>
<tr>
<td>Not be permitted for individualised use by an athlete where there is specific approval from (or reporting to) a sports supplement panel.</td>
<td>Note that the Framework will no longer name Group C supplements or supplement ingredients in this top line layer of information. This will avoid the perception that these supplements are special.</td>
<td></td>
</tr>
</tbody>
</table>

### Overview of category use within AIS system

**Evidence level:**
Banned or at high risk of contamination with substances that could lead to a positive drug test.

**Use within supplement programs:**
Should not be used by athletes.

### Sub-categories

<table>
<thead>
<tr>
<th>Stimulants</th>
<th>Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>World Anti-Doping Agency (WADA) list</td>
<td>Ephedrine, Strychnine, Sibutramine, Methylhexanamine (DMAA), Other herbal stimulants</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Prohormones and hormone boosters</th>
<th>Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>WADA list</td>
<td>DHEA, Androstenedione, 19-norandrostenone/ol, Other prohormones, Tribulus terrestris and other testosterone boosters, Maca root powder</td>
</tr>
</tbody>
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<th>GH releasers and ‘peptides’</th>
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<td>WADA list</td>
<td>Glycerol used for re/hyperhydration strategies – banned as a plasma expander, Colostrum - not recommended by WADA due to the inclusion of growth factors in its composition</td>
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### Other

| WADA list | Glycerol used for re/hyperhydration strategies – banned as a plasma expander, Colostrum - not recommended by WADA due to the inclusion of growth factors in its composition |
Protein

- Not Necessary
- Can help meet protein goals
- Convenient

- Whey is easily absorbed, good post-workout
- Casein slower absorption
- Egg
- Plant based (Peas, soy)
BCAA's

• Branched Chain AA's
• Valine, leucine, isoleucine
• Safe
• Shown to stimulate protein synthesis and delay fatigue
• Expensive!
• If no meal prior to workout may help to spare protein use for energy
Beta-Alanine

- Increases carnosine (muscle buffer)
  - leads to:
    - Increased work capacity
    - Strength gains
    - Delayed fatigue
- Used in pre-workout formulas usually in combination with other supplements (caffeine, NO, creatine, AA's)
- Side effects: Tingling of skin
- Usually 4-6 grams
Beetroot Juice

- contains nitrate, precursor to NO
- Nitric Oxide causes:
  - blood vessel dilation
  - increased oxygen delivery
  - increased nutrient delivery
  - delayed fatigue
- A very Osteopathic supplement!!
- no harmful side effects
  - may cause urine to become pink
- Higher nitrate content in:
  - arugula, spinach, lettuce, radishes
  - 500ml juice, 140ml shot
Caffeine

- ergogenic effects most likely related to CNS stimulant effects
- mobilizes FFA and spares muscle glycogen
- about 400mg considered safe for adults
- Adverse effects: anxiety, jitteriness, rapid heartbeat, GI distress, and insomnia
- no evidence as weight loss aid
- potentially dangerous levels in pre-workout or energy drinks
Milligrams of caffeine per serving

- 5-hour Energy Extra Strength: 242
- Rockstar Energy Shot: 229
- NOS High Performance Energy Drink: 224
- Monster X-presso: 221
- 5-hourEnergy: 215
- Celsius Your Ultimate Fitness Partner: 212
- Full Throttle: 210
- Stacker 2 6-Hour Power: 149
- Clif Shot Turbo Energy Gel: 133
- Arizona Energy: 129
- Guru Energy Drink: 118
- Venom Energy: 110
- Coffee, 8 oz.: 100
- Nestlé Jamba: 98
- XyienceXenergy: 94
- MonsterEnergy: 92
- Starbucks Doubleshot: 88
- Red Bull Energy Drink: 83
- Sambazon Organic Amazon Energy: 81
- Rockstar Energy Drink Double Strength: 80
- SK Street Kings 6 Hours of Energy: 78
- Red Rain Energy Drink: 75
- Steaz Energy: 72
- Bawls Guarana: 71
- AmpEnergy: 71
- Archer Farms Energy Drink Juice Infused: 55
- FRS Healthy Energy: 17
- 5-hour Energy Decaf: 6

Sources: Consumer Reports, U.S. Food and Drug Administration

Karl Tate / © MyHealthNewsDaily.com

Photo: Shutterstock
20oz Venti  
415mg caffeine

16oz Grande  
330mg caffeine

12oz Tall  
260mg caffeine

200mg caffeine
THE CAFFEINE CURVE

- Incredible Elation
- Excellent Work Habits
- God Sighted
- Feelings of Worthlessness
- Triple Shotgun Murder

First Cup: Wake Up
Second Cup
Third Cup
Fourth Cup
Fifth Cup

7am, 8am, 9am, 10am, 11am, 12pm, 1pm, 2pm, 3pm, 4pm, 5pm

Severe Depression
Normalcy
Creatine

- Naturally occurring
- Dietary sources include meat and fish
- Fuels body during high intensity activities
- Supplementation boosts levels in skeletal muscle
  - Improves performance
  - Increases lean body mass
  - Reduces fatigue
- No evidence of detrimental side effects
- Some individuals experience mild side-effects
  - Weight gain

- Creatine Monohydrate
- Suited to high intensity sports
- Sprinters, Weight lifters
- Loading phase: 4 x 5g doses per day for 5 days (20g/d)
- Maintenance: 1 x 3g dose per day for 12 weeks followed by a 3 week break

CARDIO?

IS THAT SPANISH?
Who Doesn’t Love Their Salad?!

Applebee’s Oriental Chicken Salad

- Fat: 99g
- Carb: 92g
- Protein: 40g
- Calories: 1400

BK Bacon Cheesburgers

- 5 BK Bacon Cheeseburgers
- Fat: 65g
- Carb: 135g
- Protein: 60g
- Calories: 1450
BK Chicken, Apple & Cranberry Salad
(no dressing, xtra chicken)

Fat: 11.5g
Carb: 36g
Protein: 51g
Calories: 440
Trail Mix.. America’s Healthy On-the-go Snack

480 cals
30 fat
39 carbs
12 protein

460 cals
21 fat
67 carbs
7 protein

Oikos Triple Zero Greek Yogurt

120 cals, 0 fat, 15 carbs, 15 protein (you can eat 1 of these btw)
Oikos Triple Zero Greek Yogurt

120 cals, 0 fat, 15 carbs, 15 protein (you can eat 4 of these btw)
The "most important meal" of the day...

**Fiber One Protein**
- 220 cals (1 cup)
- 6g fat
- 40g carbs
- 6g protein (10 with milk)
- 5g fiber

**Lucky Charms**
- 220 cals (1.5 cups)
- 2g fat
- 44 carbs
- 4g protein
- 4g fiber

better micronutrients!
3 eggs and spinach
210 cals, 14 fat, 3 carbs, 18 protein
Goaaaaaaaaaaaaaaaaaaaaaaaal Achieved!

//Go count those macros and eat your lucky charms!