SPORTS PERFORMANCE NUTRITION

KAREN FREEMAN MS, RDN, CSSD

UCSD VOLUNTEER CLINICAL INSTRUCTOR
SCRIPPS CENTER FOR EXECUTIVE HEALTH – LA JOLLA
SCRIPPS MEDICAL OFFICES – PRIVATE PRACTICE – DEL MAR
LOS ANGELES/SAN DIEGO CHARGERS – RETIRED

kfreemanrdsn@gmail.com
- Energy Pathways
- Carbohydrate Intake Guidelines - Fuel Availability
- Protein Intake Guidelines - Timing as a trigger for metabolic adaptation - Optimal protein sources
- Fats
- Vitamin D
- Hydration Guidelines

ENERGY PATHWAYS

- **Aerobic** (or **Aerobic Glycolysis**)
- **Lactic Acid** (or **Anaerobic Glycolysis**)
- **ATP-PC** (or **Phosphagen**)

**Axes:**
- Energy
- Time:
  - 10 secs
  - 30 secs
  - 60 secs
  - 120 secs
  - 240+ secs

**Features:**
- Power
- Speed
- Agility
- Max Strength
- Hypertrophy
- Muscular endurance
- Flexibility
<table>
<thead>
<tr>
<th>ACTIVITY</th>
<th>DURATION</th>
<th>ATP -PCr</th>
<th>CHO</th>
<th>FAT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sprint</td>
<td>0-10 secs</td>
<td>100%</td>
<td>_</td>
<td>_</td>
</tr>
<tr>
<td>110 yard dash</td>
<td>10-12 secs</td>
<td>50%</td>
<td>50%</td>
<td>_</td>
</tr>
<tr>
<td>1500 meter race</td>
<td>4-6 mins</td>
<td>6%</td>
<td>94%</td>
<td>_</td>
</tr>
<tr>
<td>10 km race</td>
<td>32-42 mins</td>
<td>_</td>
<td>100%</td>
<td>_</td>
</tr>
<tr>
<td>Marathon</td>
<td>2.5 – 3 hrs</td>
<td>_</td>
<td>75%</td>
<td>20% + 5% other</td>
</tr>
<tr>
<td>Day long hike</td>
<td>5.5 – 7 hrs</td>
<td>_</td>
<td>35%</td>
<td>65%</td>
</tr>
</tbody>
</table>

CARBOHYDRATES

VEGETABLES

WHOLE GRAINS

FRUITS
CARBOHYDRATES ➔
SUGAR “WITH A PURPOSE”

GLUCOSE
GLYCOGEN STORAGE

CHO → GLUCOSE

LIVER
GLYCOGEN
80 GRAMS

ADIPOSE TISSUE
FAT

GLUCOSE

FATTY ACIDS

BLOOD

MUSCLE GLYCOGEN
300-500 GRAMS

PCr + FAT (IMTG)
1 GM GLYCOGEN HOLDS 3 GMS H₂O
HYDRATION

HYDRATED vs DEHYDRATED

- Flexible Muscle Tissues
- Strong
- Firm

- Inflexible Muscle
- Weak
- Rigid
- Weak Tear More Easily
- Prone to Injury
## CHO GUIDELINES FOR FUELING & RECOVERY

<table>
<thead>
<tr>
<th>Activity Level</th>
<th>Situation</th>
<th>Carbohydrate Targets</th>
</tr>
</thead>
<tbody>
<tr>
<td>Light</td>
<td>Low intensity or skilled-based activities</td>
<td>3-5</td>
</tr>
<tr>
<td>Moderate</td>
<td>Moderate exercise (~1 hr./day)</td>
<td>5-7</td>
</tr>
<tr>
<td>High</td>
<td>Endurance (moderate-to-high intensity exercise of 1-3 hr./day)</td>
<td>6-10</td>
</tr>
<tr>
<td>Very high</td>
<td>Extreme commitment (moderate-to-high intensity exercise of 4-5 hr./day)</td>
<td>8-12</td>
</tr>
</tbody>
</table>

3-5 gms CARBOHYDRATES/kg body wt./day
220 # = 100 kg

3-5 gm CHO x 100 = 300-500 gms CHO

<table>
<thead>
<tr>
<th>Food</th>
<th>Serving size</th>
<th># of servings</th>
<th>CHO gms/serv.</th>
<th>Total CHO gms</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fruit or Juice</td>
<td>½ cup (baseball size)</td>
<td>12</td>
<td>15</td>
<td>180</td>
</tr>
<tr>
<td>Grains or Starches</td>
<td>1 slice bread, ½ c rice, pasta, potato, beans, cereals</td>
<td>12</td>
<td>12</td>
<td>144</td>
</tr>
<tr>
<td>Vegetables</td>
<td>1 c raw or ½ c cooked</td>
<td>8</td>
<td>5</td>
<td>40</td>
</tr>
<tr>
<td>Milk/ Yogurt</td>
<td>1 cup (8 oz.)</td>
<td>3</td>
<td>12</td>
<td>36</td>
</tr>
</tbody>
</table>

= 400
400 GMS OF CHO/DAY =

- 12 fruits or ½ c juice (180 gms)
- 8 slices of bread (120 gms)
- 8 x vegies (40 gms)
- 4 cookies - (105 gms)
- 3 x 8 oz - milk (36 gms)
WHY WE EAT ICE CREAM...

60kg x 5gms/kg = 300 gms CHO
...AND COOKIES
Workouts starts with muscle glycogen or CHO availability:

* Fast prior to training
* Sleep “low” with no breakfast
* 2x/d training
* Protein only meals/diets
* Low CHO post exercise

Short term, 3-10 weeks, may increase lipid oxidation intramuscularly.

Pitfalls:

* Can decrease immune function.
* Impair training intensity.
* Reduce ability to oxidize CHO during competition.
* Can increase muscle protein oxidation.
* Enhanced performance unclear for well trained athletes.

1 hour prior: stick to liquid, sports drinks (Low in fiber)

2 hours prior: sports drinks, toast, muffins, low fiber cereal with low fat milk, yogurt (Low in fat)

3-4 hours prior: spaghetti, French toast, eggs and toast, sandwiches: turkey, cheese, pbj (Not fried)
OFF SEASON – EASY TRAINING – INJURY REPAIR

EASY TRAINING/WEIGHT MANAGEMENT (PER MEAL)

- MILK & YOGURT
  - 1+ SERVINGS

- VEGETABLES & FRUITS
  - COOKED & RAW FRUITS & VEGGIES
  - 1/2 OF PLATE

- LEAN PROTEIN
  - BEEF
  - PORK
  - POULTRY
  - FISH
  - GAME • LAMB • EGGS • CHEESE
  - 1/4 OF PLATE

- PERFORM WITH CARB FUELS

- PREVENT WITH ANTIOXIDANTS

- JUICES & SMOOTHIES
  - 1+ SERVINGS

- GRAINS
  - STARCHES & CARBS
  - POTATOES • PASTA • RICE
  - BREADS • CEREALS • LEGUMES
  - 1/4 OF PLATE

- FATS & OILS
  - AVOCADO • OILS • NUTS
  - SEEDS • BUTTER
  - 1 TEASPOON

- PROTECT WITH GOOD FATS

POWER WITH PROTEIN
PERFORM WITH CARB FUEL
PREVENT WITH ANTIOXIDANTS
PROTECT WITH GOOD FATS
OTAs - MINI CAMP - IN SEASON

MODERATE TRAINING (PER MEAL)

MILK & YOGURT
1+ SERVINGS

VEGETABLES & FRUITS
COOKED & RAW FRUITS & VEGGIES
1/3 OF PLATE

LEAN PROTEIN
- BEEF
- PORK
- POULTRY
- FISH
GAME, LAMB, EGGS, CHEESE
1/4 OF PLATE

PERFORM WITH CARB FUELS

PREVENT WITH ANTIOXIDANTS

POWER WITH PROTEINS

JUICES & SMOOTHIES
1+ SERVINGS

GRAINS STARCHES & CARBS
POTATOES, PASTA, RICE, BREADS, CEREALS, LEGUMES
1/3 OF PLATE

FATS & OILS
AVOCADO, OILS, NUTS, SEEDS, BUTTER
1 TABLESPOON

PROTECT WITH GOOD FATS

POWER WITH PROTEIN
PERFORM WITH CARB FUEL
PREVENT WITH ANTIOXIDANTS
PROTECT WITH GOOD FATS
Can enhance performance by 2 - 3%. Effective for sport < 60 mins. Direct effects on CNS. More profound after an overnight fast.

Jeukendrup, Current Sports Medicine Reports. 2013
PROTEIN INTAKE GUIDELINES

To initiate muscle growth and repair post training (catabolic → anabolic state)

35 – 40 grams (3-4 oz) → (0.35 – 0.40 gms/kg body weight)

Within 15 minutes Post Training

Every 3-4 hours

PROTEIN: 1 oz = 7 grams

4 oz protein = 28 grams

1 oz protein = 7 grams
= 1 egg
Men

\[
220 \text{ lb.} / 2.2 = 100 \text{ kg.}
\]

\[
100 \text{ kg} \times 2.0 \text{ gm} = 200 \text{ grams protein}
\]

move decimal pt. over 1 place = 20.0 oz

WOMEN

\[
132 \text{ lb.} / 2.2 = 60 \text{ kg}
\]

\[
60 \text{ kg} \times 2.0 \text{ gm} = 120 \text{ grams protein}
\]

move decimal pt. over 1 place = 12 oz

PROTEIN NEEDS: 1.2 - 2.0 gm/kg
there is a decreased in

* Carbohydrate intake
* Energy intake
* Low Hydration
* Dehydration - ↑muscle damage
HYDRATION

HYDRATED vs DEHYDRATED

HYDRATED

- Flexible Muscle Tissues
- Strong
- Firm

DEHYDRATED

- Inflexible Muscle
- Weak
- Rigid
- Weak Tear More Easily
- Prone to Injury
<table>
<thead>
<tr>
<th>Food</th>
<th>Protein -grams</th>
<th>Leucine -miligrams</th>
</tr>
</thead>
<tbody>
<tr>
<td>3oz chicken breast</td>
<td>21</td>
<td>3690</td>
</tr>
<tr>
<td>1 cup cottage cheese</td>
<td>28</td>
<td>2880</td>
</tr>
<tr>
<td>3 oz tuna</td>
<td>24</td>
<td>1740</td>
</tr>
<tr>
<td>3 egg whites</td>
<td>21</td>
<td>990</td>
</tr>
<tr>
<td>½ cup Hummus</td>
<td>10</td>
<td>425</td>
</tr>
<tr>
<td>1/c Pumpkin seeds</td>
<td>9</td>
<td>352</td>
</tr>
<tr>
<td>1 oz chia seeds</td>
<td>4</td>
<td>352</td>
</tr>
</tbody>
</table>

Source of nutritional information: USDA National Nutrient Database for Standard Reference Release 27
Slide adapted from Don Layman, PhD, CPSDA Annual Meeting 2014
Good Fats
60% of the brain may ↓ Inflammation

Clinical Nutrition & Metabolic Care:
I'm worried. How can mankind survive without hundreds of scientifically formulated dietary supplements and a carefully planned exercise program?
SUPPLEMENTS THAT WORK

Miller, Dunn, Ciliberti, Patel, Swanson. Assoc. of Vit D w Stress Fractures: A Retrospective Cohort Study. J of Foot & Ankle Surg., Jan-Feb, 2016. vol 55, #1, p 117-120.
**Immunity:** Studies show soldiers & athletes with higher serum Vit D are less likely to develop respiratory illnesses.

**Inflammation:** NFL players with low Vitamin D serum levels were more likely to sustain muscle injuries. (Up-regulates production of anti-inflammatory cytokines).
Skeletal Muscle Function:
Involved in protein synthesis; compromised <30ng/dL*

Recovery and Rehab:
Stroke patients supplemented with 1000 IU vitamin D per day improved muscle strength and increased the relative number and size of their type II muscle fibers.

VITAMIN D SUFFICIENCY

IS CORRELATED WITH:

- optimal muscle function
- ↓ inflammation and pain
- ↑ muscle protein synthesis
- ↑ ATP concentration
- ↑ in strength
- ↑ jump height, velocity and power
- ↑ exercise capacity, and physical performance


Human Body

72% Water

Lungs: 90% water
Blood: 82%
Skin: 80%
Muscle: 75%
Brain: 70%
Bones: 22%
HYDRATION GUIDELINES
FLUID & ELECTROLYTE BALANCE

* Before: 5-10 ml/kg BW (2-4 hrs prior)
* During: 0.4-0.8 L/hr based on tolerance, experience, fluid availability.
* After: replenish 1.25 – 1.5 % of lost fluid weight
FOOTBALL HYDRATION

220 lb football player can lose:

* 8 lb sweat
* 2-3 tsp salt

during one game
Effect of Dehydration on Physical Performance

Percent Body Water Loss

- Increased Cardiovascular Strain
- Reduced Muscle Endurance
- Reduced Cognitive Function & Aerobic Endurance
- Reduced Muscle Strength
- Reduced Fine Motor Skills
- Heat Cramps
- Heat Exhaustion, Cramping, Fatigue
- Reduced Mental Capacity
- Heat Stroke
- Coma

Effect of Dehydration on Physical Performance

- Physical Exhaustion
Exercising after an overnight fast
Skipping the pre-exercise meal
Not eating enough carbohydrates
Training in the heat or cold
Participating in intense training
Participating in two-a-day + practices
Events lasting > one hour

SPORTS DRINKS (vs H2O) WHEN:
HOW TO STAY HYDRATED

TO POWER 7 MINUTES OF CONTOINOUS GAMEPLAY

TO POWER 2 MINUTES OF CONTOINOUS GAMEPLAY
Conditions that influence H₂O loss:

* Respiration while sleeping
* During air travel – 1 bottle/hour
* Altitude (e.g. Mile High Stadium)
* Changes in outdoor temperature:
  * hot ➔ cold
  * cold ➔ hot
  * humidity
HOW TO STAY HYDRATED

* upon awakening 1 - 2 bottles
* 1 hour before practice 1 bottle
* each hour of practice 1 bottle
* post practice 2 bottles
### Urine Specific Gravity (USG)

<table>
<thead>
<tr>
<th>Properly Hydrated</th>
<th>Hydrated</th>
<th>Moderately Dehydrated</th>
<th>Severely Dehydrated</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.005 - 1.010</td>
<td>1.011 - 1.020</td>
<td>1.021 - 1.029</td>
<td>1.030 + Above</td>
</tr>
</tbody>
</table>

#### Hydration Zone

![Images of urine samples representing different hydration levels]
HOW TO STAY HYDRATED:
drink 1 bottle H2O if you’re craving...

ICE CREAM

CHIPS

CHOCOLATE
1. Energy pathways dictate fuel requirements.
2. Carbohydrate remains KING.
3. Protein timing triggers metabolic adaptation for MPS optimal protein sources @ 3 – 4 oz every 3-4 hrs.
4. Fats: can be neuro-protective, reduce inflammation.
5. Vitamin D: regulates muscle recovery, inflammation, and immunity.
6. Hydration Guidelines - dehydration can be cumulative.
THANK YOU!

KAREN FREEMAN, MS, RDN, CSSD

kfreemanrdn@gmail.com
www.nutrition4health.info
“There is a difference between applied sports nutrition in a team setting and the science of sports nutrition. What is optimal and what is practical is sometimes different. If you don’t work in TEAM setting - be mindful of the comments you make towards the practice of team RDNs.”
“There is a difference between applied sports nutrition in a team setting and the science of sports nutrition. What is optimal and what is practical is sometimes different. If you don’t work in TEAM setting - be mindful of the comments you make towards the practice of team RDNs.”
Glycogen depletion increases dramatically with increasing exercise intensity. This observation is of particular importance to adjust the nutritional strategies for endurance athletes but also for athletes practicing high-intensity training sessions (e.g. team sports).
TRAINING CAMP
PRE-GAME
MODERATE TRAINING
OTAs – MINI CAMP
IN SEASON
GLYCOGEN STORAGE

CHO → GLUCOSE

LIVER
LIVER GLYCOGEN
80 GRAMS
320 KCAL

ADIPOSE TISSUE
FAT
>100,000 KCAL

MUSCLE
PCr
MUSCLE GLYCOGEN
300-500 GRAMS
1,200-2,000 KCAL
FAT (IMTG)

LIVER

GLUCOSE
FATTY ACIDS

BLOOD

2017 Los Angeles Chargers – Mini Camp Nutrition Presentation