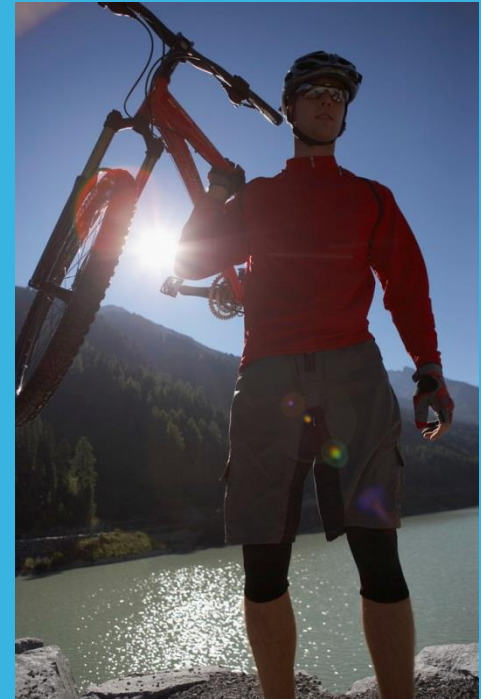


ENDURANCE CYCLING

NUTRITION AND PERFORMANCE



CAROL BRADLEY, MA, RD, LD

PHYSICAL CHARACTERISTICS

- Abdominal and back strength is crucial to body posture.
- Aerobic power is critical in conjunction with lower extremity strength.
- Upper body mass should be kept low to ↓ air resistance and load.
- Body fat percentages elite male cyclist: 8-12%
- Body fat percentage elite female cyclist: 10-15%



PERFORMANCE

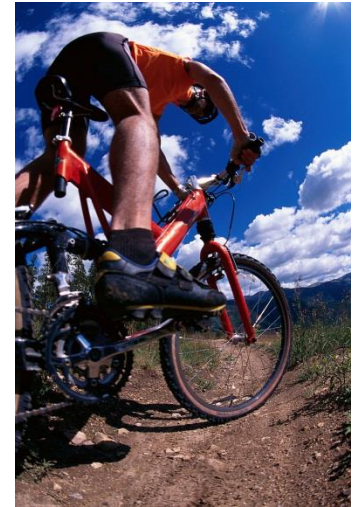
Endurance cyclists typically cover large distances in a single day:

- Length and duration of events varies
- Average race is typically 60 miles and finished in <3 hours
- 27 mph to > 50 mph.
- 9,600 revolutions (2 hrs) = average cadence of 80-90 rev's /min.
- Season = April – October with 6 - 10 major races
- Tour de France covers 2,500 miles in 3 weeks



INJURIES

- tendonitis - patellar and ileotibial band
- Crashes and collisions



TRAINING

- Circuit and criteria races every weekend
- Training session duration varies, typically 2-2½ hrs
- intensity levels varying (sprint vs. distance)
- An average cyclist bikes 200-300 miles/week



STRENGTH TRAINING



- Crucial to cycling performance.
 - Emphasis on the abdominal area, lower back, and lower extremity.
 - Eccentric exercise should be incorporated to help prevent tendinitis and aid in the healing process.
 - Stretching plays a role in the prevention of overuse injuries.
- (lower back and abdominal area should be both strong and flexible to support the riding position)



PERIODIZED TRAINING

- Produces maximal results
- Includes focusing upon distance, speed, or power on different days and weeks
- Helps prevent injury and overtraining while providing variety with a challenge



ADVANTAGES

- Bikes and jerseys allow cyclists to carry food and drinks
- Higher velocity promotes heat loss via convection
- Drafting in a pack allows for rest
- Less bouncing of the torso – tolerate solid foods



NUTRITION GOALS

- Hydration
- Adequate CHO
- Maintain muscle mass



HYDRATION

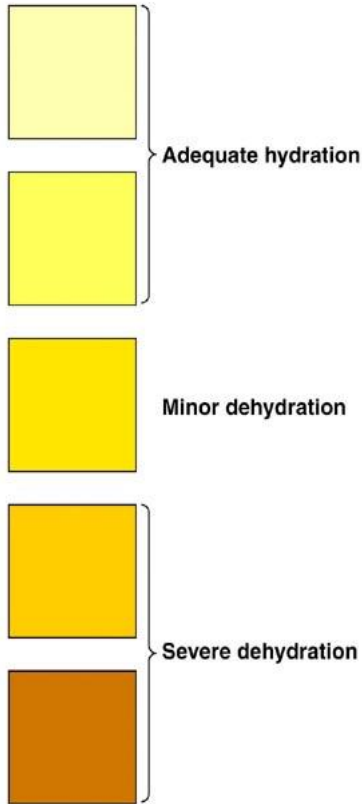


Table 9.6

Percentages of Body Fluid Loss Correlated with Weight Loss and Symptoms

% Body Water Loss	Weight Lost If You Weigh 160 lb	Weight Lost If You Weigh 130 lb	Symptoms
1–2	1.6 lb–3.2 lb	1.3 lb–2.6 lb	Strong thirst, loss of appetite, feeling uncomfortable
3–5	4.8 lb–8.0 lb	3.9 lb–6.5 lb	Dry mouth, reduced urine output, greater difficulty working and concentrating, flushed skin, tingling extremities, impatience, sleepiness, nausea, emotional instability
6–8	9.6 lb–12.8 lb	7.8 lb–10.4 lb	Increased body temperature that doesn't decrease, increased heart rate and breathing rate, dizzy, difficulty breathing, slurred speech, mental confusion, muscle weakness, blue lips
9–11	14.4 lb–17.6 lb	11.7 lb–14.3 lb	Muscle spasms, delirium, swollen tongue, poor balance and circulation, kidney failure, decreased blood volume and blood pressure

HYDRATION

Consume at least 1-2 liters of water for each hour on the bike.

Carbohydrate-electrolyte drinks help maintain higher levels of blood glucose than water (2).

Carbohydrate beverages with protein have a significant impact on improving cycling time to fatigue and reduction in muscle damage after exercise in comparison to carbohydrate beverages without protein (3).

(Limit caffeine to avoid too many pit stops)



ELECTROLYTES



- Electrolyte depletion is a concern
- Sport drinks with 110-165 mg/8 oz. of sodium
- Sport drinks with 19-46 mg/8 oz. of potassium



ENERGY NEEDS

- 600-900 kcal/hour during a race.
- > 6,000 kcal (average = 4162 – 4460kcal/day)
- requires 8-10 g of carbohydrate/kg of body weight daily
- > 2g/kg immediately post and every 2-3 hours

Note: To increase glycogen stores before and during a competition, high carbohydrate foods that cause no intestinal discomfort should be consumed.



OXIDATION OF DIFFERENT CARBOHYDRATES

Rapidly Oxidized Carbohydrates (~60 g/hr)

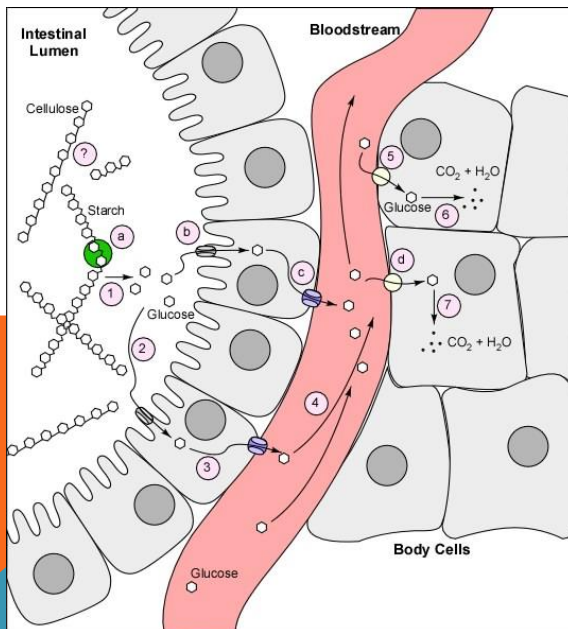
Glucose (breakdown of starch)

Sucrose (table sugar – glucose + fructose)

Maltose (2 glucose molecules)

Maltodextrins (breakdown of starch)

Amylopectin (breakdown of starch)



Slowly Oxidized Carbohydrate (~30g/hr)

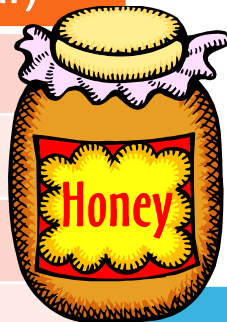
Fructose (honey, fruits, etc.)

Galactose (sugar beets)

Isomaltulose (honey and sugarcane)

Trehalose (microorganisms)

Amylose (breakdown of starch)




SUITABLE COMBINATIONS

- Glucose & fructose
- Maltodextrins & fructose
- Glucose
- Sucrose & fructose



CARBOHYDRATE IN FOODS

- $\frac{1}{2}$ cup cooked pasta, rice, potato or any other grain provides about 15 g
 - 1 medium size piece of fruit, $\frac{1}{2}$ cup of fruit juice and $\frac{1}{4}$ cup dried fruit provides 15 g
 - 1 cup of milk and $\frac{3}{4}$ cup of non-fat plain yogurt provides about 12 g
- 

PROTEIN

- Due to the high intensity of races, cyclists experience a breakdown of muscle protein during and after races, resulting in an increased need for protein.
- This can be obtained by having 15-20% of your diet protein.
- 1.2-1.4 g/kg of body weight to maintain nitrogen balance

PROTEIN

- 90 g/day, distributed evenly in 3 meals
- Minimum 30 g PRO and 2.5g leucine/meal (3 hrs.)
- Animal sources best:



Leucine (g)	Food Source
2.15	3 oz. beef
1.75	3 oz. tuna
0.85	8 oz. milk
0.60	1 egg
0.40	1/2 C edamame

25 G PRO/CALORIE COMPARISONS



**7 tablespoons
peanut butter**

670 calories

**Three 1/2 cup
servings
black beans**

374 calories

**1 1/4 cups
raw tofu**

236 calories

**3 ounces
lean beef**

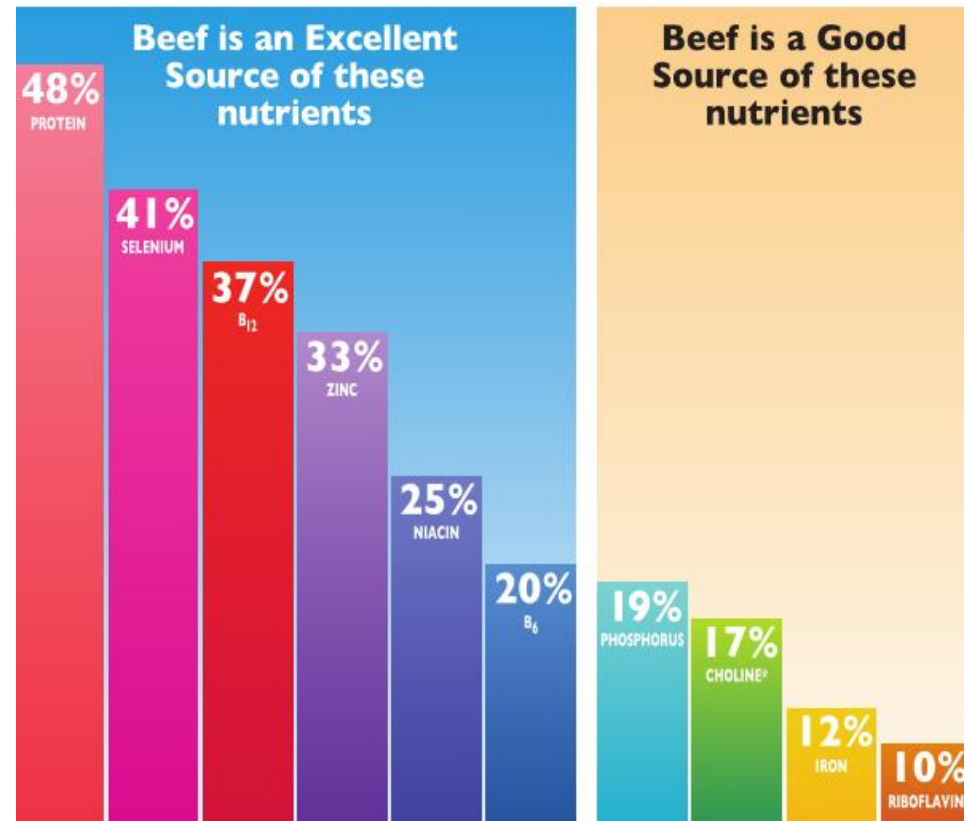
180 calories

CHOOSE YOUR CALORIES BY THE COMPANY THEY KEEP

A 3-oz serving of lean beef (154 calories) contributes less than 10% of calories to a 2,000-calorie diet, yet it supplies more than 10% of the Daily Value for:



Source: U.S. Department of Agriculture, Agricultural Research Service, 2008. USDA Nutrient Database for Standard Reference, Release 21. Based on a cooked servings, visible fat trimmed.



U.S. Department of Agriculture, Agricultural Research Service, 2009. USDA Nutrient Database for Standard Reference, Release 22. Nutrient Data Laboratory homepage www.nal.usda.gov/fnic/foodcomp

* A 3-ounce serving of lean beef provides approximately 17% of the highest adequate intake for choline (550mg).

Dietary Reference Intakes, Institute of Medicine of the National Academies, National Academies Press, Washington, DC, 2006.

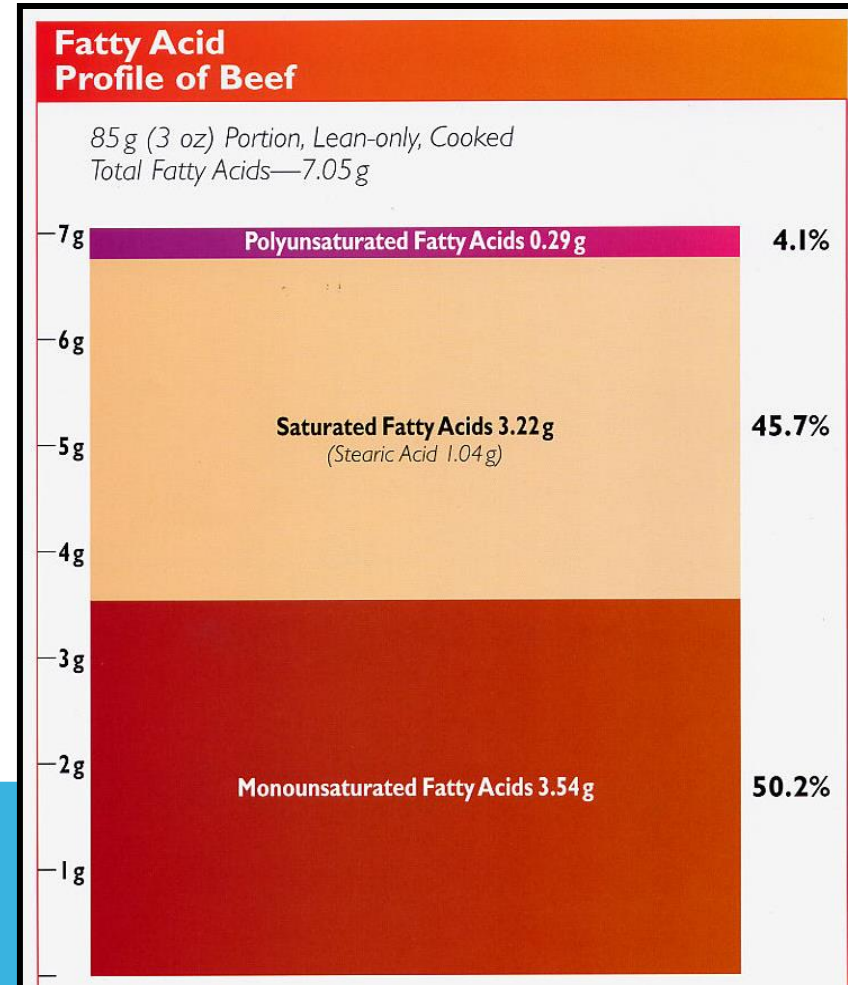
Guidance for Industry, A Food Labeling Guide. U.S. Department of Health and Human Services, Food and Drug Administration, Center for Food Safety and Applied Nutrition, April 2008. <http://www.cfsan.fda.gov/~dms/2lg-toc.html>

29 BEEF cuts that are leaner than skinless, dark meat chicken...



BEEF'S MISUNDERSTOOD FAT PROFILE

- 50% of the fats in beef are **monounsaturated**- *the same heart healthy kind found in olive oil*
- An additional 20% of the saturated fat in beef is **stearic acid**
- Both Beef and chicken have similar amounts of dietary cholesterol



REFERENCES

- 1) Wildman R, Miller, B Sports and Fitness Nutrition. Thomson Wadsworth. 2004: 455-8
- 2) Davis J M, Lamb, D R, Pate, R R, Slentz C A, Burgess W A, & Bartoli W P. Carbohydrate-electrolyte drinks: effects on endurance cycling in the heat. The American Journal of Clinical Nutrition. 1988, 48: 1023-30.
- 3) Saunder M J, Kane M D, & Todd M K. Effects of a Carbohydrate-Protein Beverage on Cycling Endurance and Muscle Damage. American College of Sports Medicine. 2004, 1233-38.