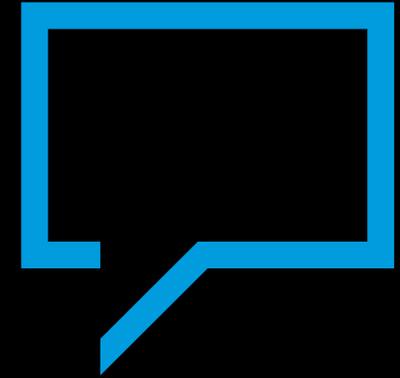




Orthopedics and  
Sports Medicine

# SPORTS NUTRITION

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APRIL 1st, 2021

# DISCLOSURE

- I have a relevant financial relationship with:
  - EXOS - Athletes' Performance Institute



# LEARNING OBJECTIVES

1. Understand the general principles of sports nutrition
2. Summarize current recommendations for pre-, during and post-exercise nutrient intake and timing
3. Design an appropriate fluid replacement protocol
4. Discuss the most common vitamin and mineral deficiencies in athletes
5. Summarize the purported and actual benefits of various supplements
6. Create an appropriate diet for weight management



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# WHAT IS SPORTS NUTRITION?

# NUTRITION

- The process of providing or obtaining the food necessary for health and growth
  - EATING TO LIVE!

## SPORTS NUTRITION

- Meeting specific energy & nutrient needs (carbs, protein, fat, kcal's, vitamins, minerals) to support exercise & improve performance
- Meeting specific fluid needs to prevent dehydration during exercise & re-hydrate after exercise
- Meeting specific timing needs (pre-workout/post-workout) to prevent tissue breakdown & promote recovery and regeneration
- Using supplementation to enhance performance outcomes & speed up recovery

# SPORTS NUTRITION

- *Factors to consider:*
  - Body type & composition (body fat %, fat mass, fat-free mass)
  - Athletic goals
  - Type of exercise (aerobic vs anaerobic/endurance vs strength)
  - Time of exercise (morning vs evening)
  - Frequency of exercise (one-a-day, two-a-day)
  - Environmental conditions (temperature, humidity, elevation)
  - Competition season (pre-season, in-season, off-season)
  - Allergies & Intolerances
  - Genetics!

# ENERGY & NUTRIENT REQUIREMENTS

# ENERGY & NUTRIENT REQUIREMENTS

- Energy (Calories)
- Carbohydrate
- Protein
- Fat
- Fluid

## Two Methods:

1. Calculate Energy Needs
  - Determine Nutrients (carbs/protein/fat)
1. Calculate Nutrient Needs
  - Determine Energy

# ENERGY REQUIREMENTS (Method 1)

## Energy Calculation

- Total Daily Energy Expenditure (TDEE)
  - = Basal Metabolic Rate (BMR) - 60 - 70%
  - + Non-Exercise Activity Thermogenesis (NEAT) - 10 - 15%
  - + Thermic Effect of Food (TEF) - 5 - 10%
  - + Thermic Effect of Activity (TEA) - 15 - 20%

(BMR = Harris-Benedict, Mifflin-St.Jeor, Katch-McArdle\*)

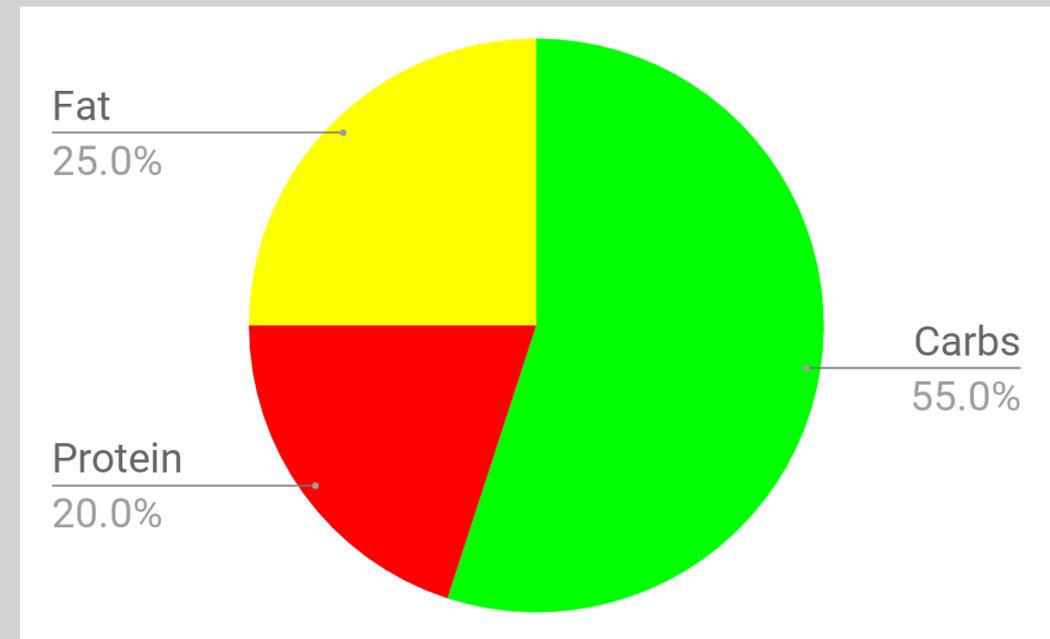
\*Uses body fat %

# ENERGY REQUIREMENTS (Method 1)

- Carbohydrate - 50 - 60% of total calories
- Protein - 15 - 20% of total calories
- Fat - 20 - 30% of total calories

*\*May change depending on athlete needs, goals, training intensity, etc*

*\*\*Every day may look different*



# ENERGY REQUIREMENTS (Method 2)

## Macronutrient Calculation

	<b>LIGHT ACTIVITY</b> (low -intensity or skill based activities)	<b>MODERATE ACTIVITY</b> (moderate exercise for 1 hour per day)	<b>HIGH ACTIVITY</b> (1– 3 hours at high intensity)	<b>VERY HIGH ACTIVITY</b> (4 – 5 hours at high intensity)
<b>CARBOHYDRATE</b>	3 – 4 g/kg/day	5 – 7 g/kg/day	6 – 10 g/kg/day	8 – 12 g/kg/day
<b>PROTEIN</b>	1.0– 1.2 g/kg/day	1.2– 1.6 g/kg/day	1.6– 1.8 g/kg/day	1.8– 2.2+ g/kg/day
<b>FAT</b>	0.8 – 1.0 g/kg/day	1.0– 1.2 g/kg/day	1.2– 1.4 g/kg/day	1.4– 1.6 g/kg/day

*\* Modifications can be made based on specific needs*

# EXAMPLE

- 20 yo male
- 5'10" (178 cm or 1.78 m)
- 175 lbs (79.5 kg)
- Practice 5x/week (90 mins) + Strength-Training 3x/week (60 mins)

	ENERGY CALCULATION (TDEE x 55/20/25)	NUTRIENT CALCULATION (Weight x 5.5/2.0/1.2)
CARBOHYDRATES	440 g	437 g
PROTEIN	160 g	159 g
FAT	90 g	95 g
CALORIES	~3200	~3200

\*To **MAINTAIN** weight

# PRE-, DURING & POST-EXERCISE

# PRE-EXERCISE

- Carbohydrates to sustain energy levels & boost performance
- Protein to preserve muscle mass
- Fat to protect joints & prevent tissue breakdown
- Fluid to stay hydrated & avoid dehydration

TIMING	NUTRIENTS	AMOUNT
1–4 hours prior to activity	CARBOHYDRATE	1–4 g/kg
	PROTEIN	0.4 – 0.5 g/kg
	FAT	<i>minimal</i>
	FLUID	16 - 20 oz
0 – 1 hour prior to activity	CARBOHYDRATE	25 – 30 g
	PROTEIN	0.1– 0.2 g/kg
	FAT	<i>minimal</i>
	FLUID	Drink based on thirst

# DURING EXERCISE

- Fluid to stay hydrated & avoid dehydration
- Carbohydrates to provide immediate fuel & energy
- Protein to prevent muscle breakdown

**\*6 – 8% carbohydrate-electrolyte solution  
(6 – 8 g CHO/100 mL)**

TIMING	NUTRIENTS	AMOUNT
Less than <b>60 minutes</b>	CARBOHYDRATE	<i>none</i>
	PROTEIN	<i>none</i>
	FAT	<i>none</i>
	FLUID	Drink based on thirst
More than <b>60 minutes</b>	CARBOHYDRATE	30 – 60 g/hour
	PROTEIN	15 g/hour
	FAT	<i>none</i>
	FLUID*	6 - 12 oz/15 min
	Electrolytes – Sodium	450 – 700 mg

# POST-EXERCISE

- Protein to repair & restore lean muscle mass
- Carbohydrates to re-fuel & support future performance
- Fat to decrease inflammation & muscle soreness
- Fluid to re-hydrate

TIMING	NUTRIENTS	AMOUNT
<b>0 – 60 minutes</b> after activity	CARBOHYDRATE	0.5 - 0.6 g/kg
	PROTEIN	0.25 g/kg
	FAT	<i>minimal</i>
	FLUID	35 - 45 oz/kg lost
<b>Every 2 hours</b> after activity (for 4 – 6 hours)	CARBOHYDRATE	0.5 - 0.6 g/kg
	PROTEIN	0.25 - 0.4 g/kg
	FAT	10 – 20 gram s
	FLUID	35 - 45 oz/kg lost

# FLUID REPLACEMENT PROTOCOL

# FLUID REQUIREMENTS & REPLACEMENT

## Total Daily Fluid Needs (in ounces)

= Body Weight (lbs)/2

+ Fluid loss during exercise (sweat rate)

**Sweat Rate\*** = (A + B) / C

- A. Pre-Exercise Weight - Post-Exercise Weight
- B. Fluid Intake (during exercise)
- C. Exercise Duration (hours)

\*Typically 20 oz per hour

# FLUID REQUIREMENTS & REPLACEMENT

- 20 yo male
- 5'10" (178 cm or 1.78 m)
- 175 lbs (79.5 kg)
- Practice 5x/week (90 mins) + Strength-Training 3x/week (60 mins)

## Total Daily Fluid Needs

= 175 lbs/2

= 88 oz + 20 oz lost per hour of exercise

= 118 oz/day (with 90 minute practice)

# FLUID REPLACEMENT

## 3 STEPS:

- **STEP 1:** Measure weight pre-exercise
- **STEP 2:** Measure weight post-exercise
- **STEP 3:** Drink **35- 45** oz of water for every kilogram lost
  - 175 lbs pre-exercise
  - 173 lbs post-exercise
  - 2 lbs (1 kg) loss
  - Drink 35 - 45 oz



# VITAMIN & MINERAL DEFICIENCY

# ROLE OF MICRONUTRIENTS

- Energy production
- Hemoglobin synthesis
- Bone health
- Immune function
- Protection against oxidative damage
- Synthesis and repair of muscle tissue

**ACSM** – “there is **NO** scientific evidence to support the general use of vitamin and mineral supplements to improve athletic performance”

**ACSM/AND/DC** – “Athletes who restrict energy intake or have severe weight-loss practices, who eliminate one or more of the food groups from their diet, or who consume unbalanced and low micronutrient-dense diets may benefit from a daily multivitamin-and-mineral supplement”

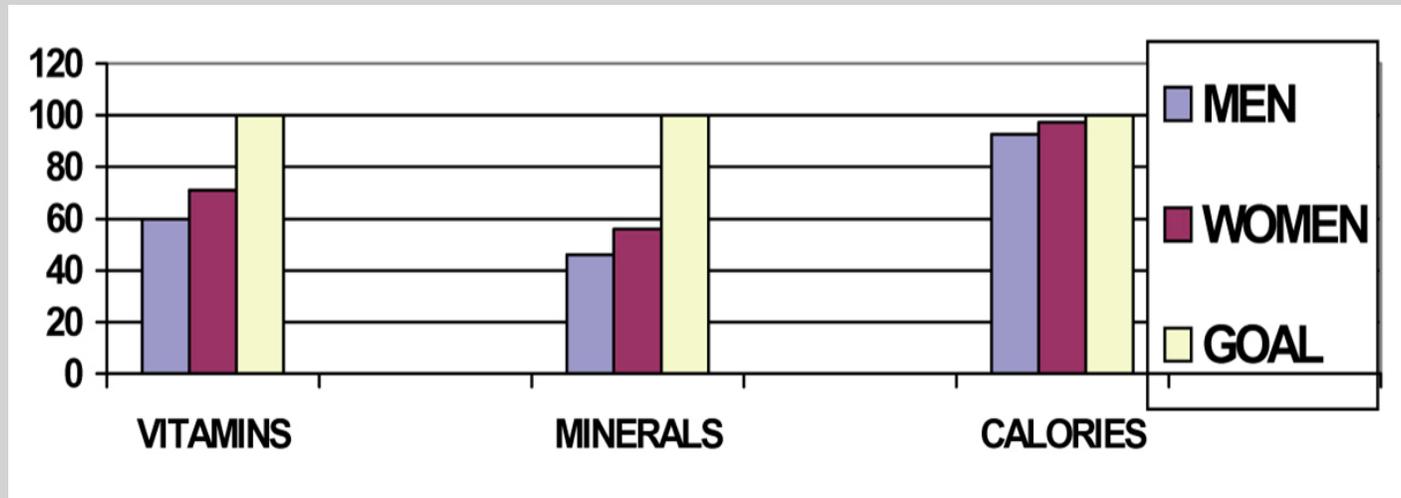
# VITAMINS & MINERALS

Vitamin Deficiencies (1 or more):

- 40% of athletic males
- 30% of athletic females

Mineral Deficiencies (1 or more):

- 55% of athletic males
- 45% of athletic females



# COMMON DEFICIENCIES

%	VITAMINS	PERFORMANCE ROLE
95	<b>Vitamin D</b> (sunshine, salmon)	Facilitates Calcium Absorption into Bones
65	<b>Vitamin E</b> (almonds, spinach)	Protect Cell Membrane from Oxidative Damage (antioxidant)
30	<b>Vitamin B6</b> (turkey, beef)	Energy Production
25	<b>Riboflavin</b> (beef, lamb)	Energy Production
20	<b>Thiamin</b> (peas, asparagus)	Energy Production
20	<b>Vitamin B12</b> (beef liver, sardines)	Red Blood Cell Production Protein Synthesis CNS Maintenance
15	<b>Folate</b> (chickpeas, lentils)	Red Blood Cell Production Protein Synthesis CNS Maintenance
10	<b>Niacin</b> (turkey, chicken)	Energy Production
~	<b>Pantothenic Acid &amp; Biotin</b>	Energy Production

%	MINERALS	PERFORMANCE ROLE
80	<b>Zinc</b> (lamb, beef)	Supports Growth, Building & Repair of Muscle Tissue
50	<b>Calcium</b> (milk, yogurt, kale)	Growth, Maintenance & Repair of Bone Tissue
45	<b>Selenium</b> (Brazil nuts)	Protect Cell Membrane from Oxidative Damage (antioxidant)
40	<b>Magnesium</b> (spinach, chard)	Cellular Metabolism Neuromuscular Function
20	<b>Sodium, Potassium &amp; Chloride</b>	Electrolyte Balance Nerve Transmission
10*	<b>Iron</b> (liver, beef)	Part of Oxygen -Carrying Proteins, Hemoglobin & Myoglobin

# SUPPLEMENTATION

# SUPPLEMENTATION

## Sports Nutrition Supplement Facts:

- Over \$30 billion in retail sales in 2019
- 2/3rd of athletes took at least one supplement
- Elite athletes took supplements more often than non-elite athletes
- Men take more protein and creatine
- Women take more iron
- Main reasons for taking a supplement:
  - Muscle growth
  - Muscle strength
  - Performance enhancement
  - Increased endurance

RANK	SUPPLEMENT	PROPOSED BENEFIT	EVIDENCE OF EFFICACY
1	Whey Protein Isolate	Increases fat loss Increases lean muscle mass	Numerous clinical trials with consistent results
2	Pre -Workout (with Caffeine)	Increases anaerobic capacity Increases aerobic capacity Increases power output	Numerous clinical trials with consistent results
3	Creatine	Increases power output Increases weight & lean muscle mass Increases anaerobic cardiovascular capacity	Numerous clinical trials with consistent results
4	BCAA's	Increases lean muscle mass Increases fat oxidation Decreases fatigue	Limited number of clinical trials
5	Multivitamins	Prevents/Treats deficiency	Numerous clinical trials with conflicting results
6	HMB (metabolite of Leucine)	Decreases muscle damage	Numerous clinical trials with conflicting results
7	Testosterone Boosters (DHEA)	Increases strength Increases lean muscle mass	Small number of clinical trials that show no benefit for physical performance
8	Beta -Alanine	Increases muscle endurance	Numerous clinical trials with conflicting results



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# WEIGHT MANAGEMENT

## Weight **MAINTENANCE**:

- Total Daily Energy Expenditure (TDEE)
- Establish appropriate nutrient requirements

## Weight **GAIN**:

- Total Daily Energy Expenditure (TDEE) + 15 - 20% kcal (surplus)
- Increase Carbohydrate & Protein (1.4 - 3.3 g/kg)
- Maintain Fat

## Weight **LOSS**:

- Total Daily Energy Expenditure (TDEE) - 15 - 20% kcal (deficit)
- Reduce Carbohydrate
- Maintain Fat
- Increase Protein (up to 2.3 - 3.1 g/kg)

## Weight GAIN:

- + Realistic weight gain (muscle) is 0.25 - 0.5 lbs (Men) & 0.12 - 0.25 lbs (Women) per week

***EXAMPLE*** 175 lbs athlete has a goal weight of **180 lbs**

- + TDEE + 15 - 20% kcal
- +  $3200 \times 0.2 = 640$  kcal surplus
- + Athlete follows a 3840 (~3800) kcal diet
  - Protein intake of 1.4 - 3.3 g/kg = 111 - 262 grams/day

## Weight LOSS

- + Sustainable weight loss is 0.5 - 1.5 lbs per week (*do not exceed 1.5% of body weight*)
- + 1 lb of fat = 3500 kcal

**EXAMPLE** 175 lbs athlete has a goal weight of **170 lbs**

- + TDEE - 15 - 20% kcal
- +  $3200 \times 0.2 = 640$  kcal deficit
- + Athlete follows a 2560 (~2600) kcal diet
  - o Protein intake of 2.3 - 3.1 g/kg = 183 - 246 grams/day
- + 5 days to lose 1 lb of fat & 1 month to lose 5 lbs

## Weight LOSS

	WEIGHT LOSS (15 - 20% deficit)		WEIGHT MAINTAIN		WEIGHT GAIN (15 - 20% surplus)	
CARBOHYDRATES	277 g	3.5 g/kg	425 g	5 g/kg	535 g	7 g/kg
PROTEIN	190 g	<b>2.4 g/kg</b>	160 g	2.0 g/kg	175 g	2.2 g/kg
FAT	87 g	1.1 g/kg	95 g	1.2 g/kg	104 g	1.3 g/kg
CALORIES	~2600		~3200		~3800	

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**THANK YOU!**