Nutrition in Overuse Injuries

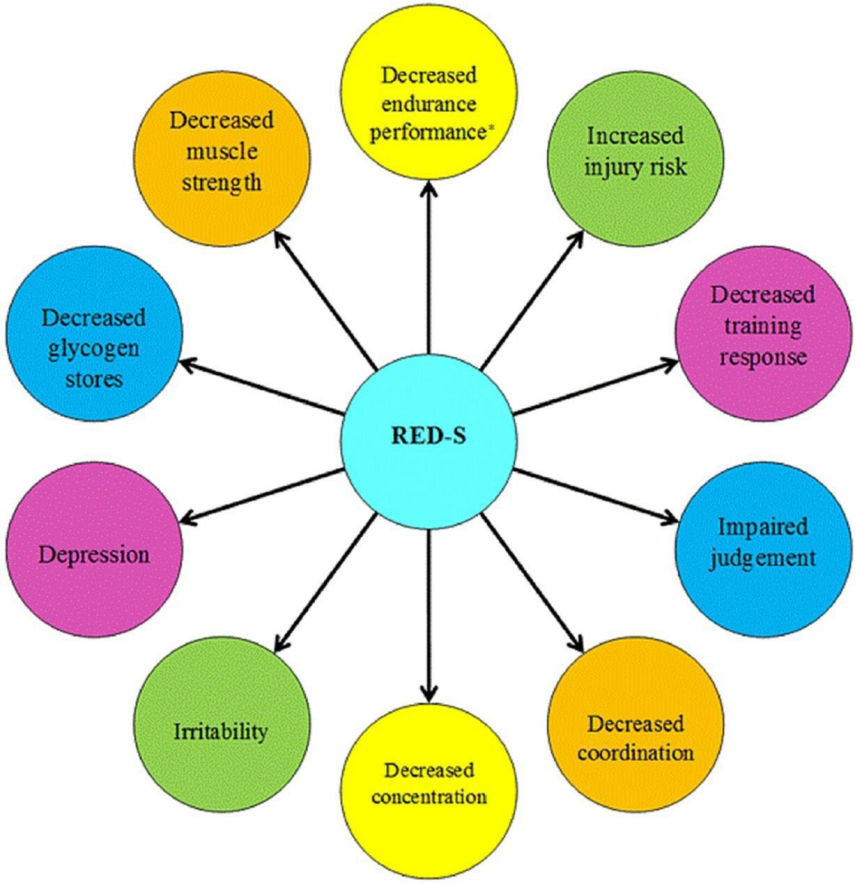
Amanda McCarthy MS, RDN, CSSD
Program Coordinator
Sports Dietitian

SPORTS MEDICINE CENTER
Children's Hospital Colorado

Promoting Optimal Recovery

Energy availability (EA)
Substrate needed for activity load

EA: >45kcal/kg FFM in females; >40kcal/kg FFM in males
Protein: 1.5g/kg/d
Carb: min 5g/kg/d, matched for exercise output
Fat: 1g/kg/d, omega 3 intake



Nutrition Timing

- Pre-event meal:
  - 1-4g/kg carb consumed 1-4hr prior
- For immediate recovery after exercise:
  - (0–4hrs): 1–1.2g/kg/h carb, then resume daily fuel needs
  - 0.11g/kg protein bolus
- For daily recovery:
  - low intensity or skill based activity: 3–5 g/kg/d
  - moderate exercise program (e.g., training 1 hr/d): 5–7g/kg/d
  - endurance program (e.g., training 1–3 hr/d): 6–10g/kg/d
  - extreme exercise program (e.g., training 4–5 hr/d): 8–12g/kg/d
- During sport:
  - short duration (0–75 min): not required or very small amount
  - medium/long duration (75min-2.5h): 30–60g/h

Hydration

3% body weight losses from dehydration may reduce muscular power, increase fatigue, increase risk of injury

- Sweat rates may be as high as 2.1L/hr, 4% body weight losses

- Limit body mass losses during exercise <2%
    - 13mL/kg/hr fluid during exercise

NCAA A Fact Sheet for Student Athletes: Assess Your Hydration Status
https://www.cscca.org/document?id=588

Micronutrient Intake

Teen athletes typically low in: fruit, veggies, dairy

- calcium, D, iron, folate, potassium

High in: sugar sweetened beverages

MICRONUTRIENTS	SOURCES	FUNCTION
Vitamin C	Citrus fruit, red and green peppers, cantaloupe	Antioxidant, wound healing, tissue repair, immune function
Vitamin A	Sweet potato, spinach, carrots, tomatoes	Cell growth and development, immune function
Vitamin D	Sun exposure, oily fish, dairy products, fortified foods	Promotes calcium absorption and bone health
Calcium	Low-fat milk, fortified non-dairy milk, low-fat Greek yogurt, cheese, broccoli, kale, fortified orange juice	Supports skeletal structure and function
Magnesium	Almonds, sesame and sunflower seeds, cashews, peanuts, bananas	Nucleic acid and protein synthesis, improves absorption and metabolism of calcium and vitamin D, improves circulation
Zinc	Lean beef, crabmeat, chicken, cashews, fortified cereals	Wound healing, protein synthesis, immune function
Copper	Sesame, pumpkin and sunflower seeds, cashews, shiitake mushrooms	Assists with red blood cell (RBC) formation, immune function and bone health, regenerates elastin

Tipton KD, 2015

Micronutrient Intake

Table 2: Selenium Content of Selected Foods [10]

Food	Micrograms (mcg) per serving	Percent DV*
Brazil nuts, 1 ounce (6–8 nuts)	544	989
Tuna, yellowfin, cooked, dry heat, 3 ounces	92	167
Halibut, cooked, dry heat, 3 ounces	47	85
Sardines, canned in oil, drained solids with bone, 3 ounces	45	82
Ham, roasted, 3 ounces	42	76
Shrimp, canned, 3 ounces	40	73
Macaroni, enriched, cooked, 1 cup	37	67
Beef steak, bottom round, roasted, 3 ounces	33	60
Turkey, boneless, roasted, 3 ounces	31	56
Beef liver, pan fried, 3 ounces	28	51
Chicken, light meat, roasted, 3 ounces	22	40
Cottage cheese, 1% milkfat, 1 cup	20	36
Rice, brown, long-grain, cooked, 1 cup	19	35
Beef, ground, 25% fat, broiled, 3 ounces	18	33

NIH Selenium Fact Sheet for Health Professionals

Omega-3's

Ideal intake: 1-3g/day

6oz salmon= 1.8-4.5g/serving (wild:farmed)

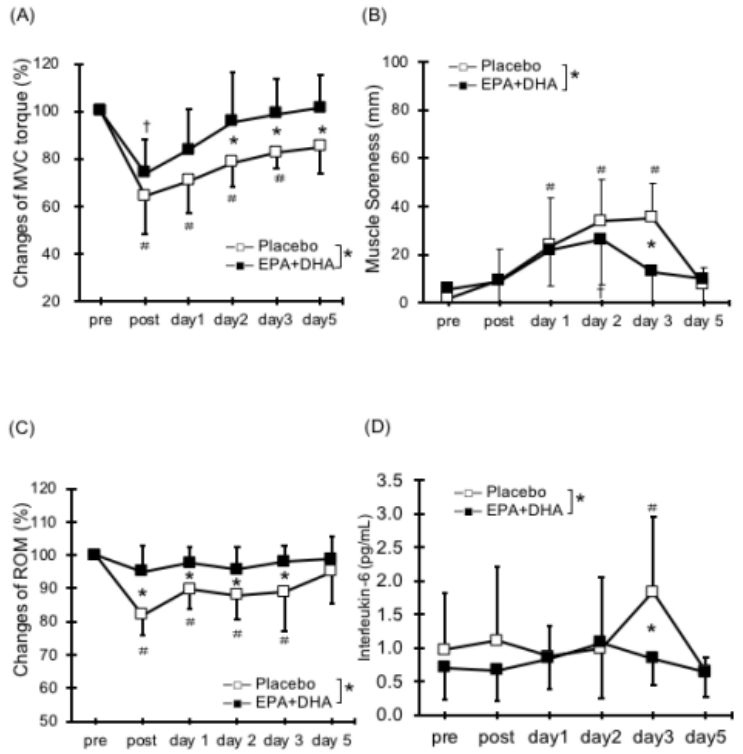


Figure 1. Changes (means ± SD) in: maximal voluntary isometric contraction (MVC) torque (**A**); muscle soreness (**B**); range of motion (ROM) (**C**); and Interleukin (IL)-6 (**D**), before (pre), immediately after (post), and 1, 2, 3, and 5 days after eccentric contractions in EPA group and placebo. * ($p < 0.05$); significant difference between groups, † ($p < 0.05$); significant difference from pre-exercise value in EPA group, # ($p < 0.05$); significant difference from pre-exercise value in placebo group (data are from Tsuchiya et al., 2016).

Ochi E. 2018

Polyphenols

TABLE 1 Polyphenols in foods

		Polyphenol content	
	Source (serving size)	**By wt or vol**	**By serving**
		mg/kg fresh wt (or mg/L)	*mg/serving*
Hydroxybenzoic acids (2, 6)	Blackberry (100 g)	80–270	8–27
Protocatechuic acid	Raspberry (100 g)	60–100	6–10
Gallic acid	Black currant (100 g)	40–130	4–13
p-Hydroxybenzoic acid	Strawberry (200 g)	20–90	4–18
Hydroxycinnamic acids (2, 5–7)	Blueberry (100 g)	2000–2200	200–220
Caffeic acid	Kiwi (100 g)	600–1000	60–100
Chlorogenic acid	Cherry (200 g)	180–1150	36–230
Coumaric acid	Plum (200 g)	140–1150	28–230
Ferulic acid	Aubergine (200 g)	600–660	120–132
Sinapic acid	Apple (200 g)	50–600	10–120
	Pear (200 g)	15–600	3–120
	Chicory (200 g)	200–500	40–100
	Artichoke (100 g)	450	45
	Potato (200 g)	100–190	20–38
	Corn flour (75 g)	310	23
	Flour: wheat, rice, oat (75 g)	70–90	5–7
	Cider (200 mL)	10–500	2–100
	Coffee (200 mL)	350–1750	70–350

Anthocyanins

Anthocyanins (8–10)	Aubergine (200 g)	7500	1500
Cyanidin	Blackberry (100 g)	1000–4000	100–400
Pelargonidin	Black currant (100 g)	1300–4000	130–400
Peonidin	Blueberry (100 g)	250–5000	25–500
Delphinidin	Black grape (200 g)	300–7500	60–1500
Malvidin	Cherry (200 g)	350–4500	70–900
	Rhubarb (100 g)	2000	200
	Strawberry (200 g)	150–750	30–150
	Red wine (100 mL)	200–350	20–35
	Plum (200 g)	20–250	4–50
	Red cabbage (200 g)	250	50

Flavonols

Flavonols (11–18)	Yellow onion (100 g)	350–1200	35–120
Quercetin	Curly kale (200 g)	300–600	60–120
Kaempferol	Leek (200 g)	30–225	6–45
Myricetin	Cherry tomato (200 g)	15–200	3–40
	Broccoli (200 g)	40–100	8–20
	Blueberry (100 g)	30–160	3–16
	Black currant (100 g)	30–70	3–7
	Apricot (200 g)	25–50	5–10
	Apple (200 g)	20–40	4–8
	Beans, green or white (200 g)	10–50	2–10
	Black grape (200 g)	15–40	3–8
	Tomato (200 g)	2–15	0.4–3.0
	Black tea infusion (200 mL)	30–45	6–9
	Green tea infusion (200 mL)	20–35	4–7
	Red wine (100 mL)	2–30	0.2–3
Flavones (11–12, 14, 18)	Parsley (5 g)	240–1850	1.2–9.2
Apigenin	Celery (200 g)	20–140	4–28
Luteolin	Capsicum pepper (100 g)	5–10	0.5–1
Flavanones (19–21)	Orange juice (200 mL)	215–685	40–140
Hesperetin	Grapefruit juice (200 mL)	100–650	20–130
Naringenin	Lemon juice (200 mL)	50–300	10–60

Flavonols

Isoflavones (22–25)	Soy flour (75 g)	800–1800	60–135
Daidzein	Soybeans, boiled (200 g)	200–900	40–180
Genistein	Miso (100 g)	250–900	25–90
Glycitein	Tofu (100 g)	80–700	8–70
	Tempeh (100 g)	430–530	43–53
	Soy milk (200 mL)	30–175	6–35
Monomeric flavanols (6, 17, 26, 27)	Chocolate (50 g)	460–610	23–30
Catechin	Beans (200 g)	350–550	70–110
Epicatechin	Apricot (200 g)	100–250	20–50
	Cherry (200 g)	50–220	10–44
	Grape (200 g)	30–175	6–35
	Peach (200 g)	50–140	10–28
	Blackberry (100 g)	130	13
	Apple (200 g)	20–120	4–24
	Green tea (200 mL)	100–800	20–160
	Black tea (200 mL)	60–500	12–100
	Red wine (100 mL)	80–300	8–30
	Cider (200 mL)	40	8

Tart Cherries

45-60 whole cherries 2x/d or 8-12oz juice 2x/d

Benefits:

Muscle function

Oxidative stress

Inflammation- inhibits COX-2

Pain- reduction in DOMS

Sleep

Limitations:

Water sports

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Practical Application

Consistent fueling, even protein distribution throughout the day
Adequate fruit and veggie intake (5c/d)
Fatty fish 2x/wk
Drinking throughout the day (2-3L/d for most athletes)

Limitations
More studies needed in overuse injuries
Pickiness/compliance in teens
Cost

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