

Nutrition for Running

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Overview

- The Fuel – macronutrients and calories
- The Carburetor – micronutrients
- Fueling strategies
- The Oil – fluids
- Hydration strategies
- The Big Race!



The Fuel – Macronutrients and Calories

- **Macronutrients**
 - Carbohydrates
 - Protein
 - Fat
- **Calories**



Carbohydrate

- “When glucose runs out, the athlete stops performing; therefore understanding how to keep glucose from becoming depleted should become a major focus of an athlete’s nutrition practices.”

- Dan Benardot, PhD, RD, FACSM, Author of *Advanced Sports Nutrition*

Carbohydrate - Types

- **Simple carbohydrates**
 - Monosaccharides – glucose, fructose, galactose
 - Disaccharides – maltose, lactose, sucrose
- **Complex carbohydrates**
 - Starch
 - Glycogen
 - Fiber
- **Other carbohydrates**
 - Sugar alcohols

Carbohydrate - General Functions

- Energy and muscular fuel
- Cholesterol and fat control
- Digestion assistance

Carbohydrate – Special Considerations in Runners

- Provide energy to satisfy the majority of caloric needs
- Optimize glycogen stores
- Allow for muscle recovery after physical activity
- Provide a quick, easy, well tolerated source of energy between meals to maintain blood glucose

Carbohydrate – Special Considerations in Runners

- Muscle glycogen
 - 350 grams (1400 calories)
 - Used as fuel for muscle work
- Liver glycogen
 - 90 grams (360 calories)
 - Used to stabilize blood glucose
- Blood glucose
 - 5 grams (20 calories)
 - Used as fuel for central nervous system

Carbohydrate – Special Considerations in Runners

- The higher the exercise intensity, the greater the reliance on carbohydrate for energy
- Even low intensity exercise requires carbohydrate to use fat for energy and maintain blood glucose
- Carbohydrate most efficient fuel source

Carbohydrate - Requirements

- Minimum intake
 - 130 grams per day
- Optimal intake
 - 3.2 – 4.5 grams per pound of body weight per day
- 4 calories per gram
- Calculate calories from carbohydrates

Carbohydrate - Sources

- Complex, unrefined carbohydrates should be the major focus of carbohydrate intake
- Simple and refined carbohydrates should be consumed during and immediately following exercise

Protein - Types

- Amino acids are the building blocks of protein
 - Essential amino acids
 - Non-essential amino acids
- Nitrogen-containing compounds

Protein – General Functions

- Contribution of essential amino acids
- Development of new tissue
- Maintenance of existing tissue
- Basic substrate in the manufacture of enzymes, antibodies and hormones
- Fluid balance
- Carrier of substances in the blood
- Energy source

Protein – Special Considerations in Runners

- Maintenance of existing tissue
 - Muscle
- Energy source
- An inadequate total energy intake and/or carbohydrate intake forces athletes to burn protein for energy making less protein available for other critical functions, such as muscle recovery

Protein - Requirements

- 0.55 – 0.75 grams per pound body weight per day
- 4 calories per gram
- Calculate calories from protein

Protein - Sources

- Legumes
- Nuts and seeds
- Grains
- Meats and dairy products

Fat - Types

- Triglycerides
 - Glycerol
 - Three fatty acids
 - Saturated fatty acids
 - Unsaturated fatty acids
 - Monounsaturated fatty acids
 - Polyunsaturated fatty acids
 - Omega 3
 - Omega 6
 - Trans fatty acids

Fat – General Functions

- Energy storage
- Energy source
- Delivery of fat soluble vitamins
- Contribution of essential fatty acids
- Satiety control
- Substance in many hormones

Fat – Special Considerations in Runners

- Energy storage in adipose tissue
 - 50,000 – 100,000 calories
- Energy storage in muscle tissue
 - 2,000 – 3,000 calories
- The lower the exercise intensity, the greater the reliance on fat for energy

Fat – Requirements

- 0.35 – 0.6 grams per pound body weight per day
- 9 calories per gram
- Calculate calories from fat

Fat - Sources

- Saturated fatty acids
 - Meats and dairy products
 - Eggs
 - Palm kernel oil
 - Coconut Oil
- Monounsaturated fatty acids
 - Olive oil
 - Canola oil
 - Nuts
 - Avocado
- Polyunsaturated fatty acids
 - Vegetable oils
 - Fatty fish and fish oil
- Trans fatty acids
 - Processed foods

Calories

- Total calories
 - Calories from carbohydrates
 - Calories from protein
 - Calories from fat
- Surveys of endurance athletes demonstrate on average an inadequate consumption of calories, an over reliance on protein and fat and an under reliance on carbohydrate needed for optimal performance

The Carburetor – Micronutrients

- Vitamins
 - Water soluble vitamins
 - Fat soluble vitamins
- Minerals
 - Major minerals
 - Trace minerals



Water Soluble Vitamins

- B complex
 - Thiamin
 - Riboflavin
 - Niacin
 - Vitamin B6
 - Vitamin B12
 - Folic acid
 - Biotin
 - Pantothenic acid
- Vitamin C

Water Soluble Vitamins – General Functions

- Energy production
 - Conversion of food energy to muscle energy and heat
 - Conversion of muscle glycogen to muscle energy
- Glycogen synthesis
- Amino acid and protein synthesis
- Cellular metabolism and function
- Red blood cell formation
- Antioxidant
- Formation of connective tissue collagen

Water Soluble Vitamin – Special Considerations in Runners

- Poor Vitamin B6 status reduces athletic performance
- Vegan athletes should consume foods fortified with Vitamin B12, such as soy milk products, or should consume a Vitamin B12 supplement

Water Soluble Vitamin – Requirements and Sources

- Thiamin
 - 2.2 – 2.4 milligrams/day
 - Whole grains, legumes, nuts, pork
- Riboflavin
 - 1.1-1.3 milligrams/1,000 calories
 - Dairy products, dark green leafy vegetables, whole grain foods and enriched grain foods
- Niacin
 - 14-20 milligrams/day
 - Meat, whole or enriched grains, seeds, nuts, legumes

Water Soluble Vitamin – Requirements and Sources

- Vitamin B6
 - 1.5-2.0 milligrams/day
 - Meats, wheat germ, fish, poultry, legumes, bananas, brown rice, whole grain cereals, vegetables
- Vitamin B12
 - 2.4-2.5 micrograms/day
 - Foods of animal origin
- Folic Acid
 - 400 micrograms/day
 - Liver, yeast, leafy vegetables, fruits, legumes and fortified grain products

Water Soluble Vitamin – Requirements and Sources

- Biotin
 - 30 micrograms/day
 - Egg yolks, soy flour, liver, sardines, walnuts, pecans, peanuts, yeast
 - Bacteria in human large intestine can synthesize biotin
- Pantothenic acid
 - 4-5 milligrams/day
 - Meats, whole grain foods, beans, peas
- Vitamin C
 - 200 milligrams/day
 - Fresh fruits and vegetables

Fat Soluble Vitamins

- Vitamin A
- Vitamin D
- Vitamin E
- Vitamin K

Fat Soluble Vitamins – General Functions

- Vision
- Structure
- Immune system function
- Red blood cell health
- Antioxidant

Fat Soluble Vitamins – Special Considerations in Runners

- Vitamin D deficiency leads to greater risk for stress fractures due to lower bone density
- Mixed results in studies evaluating Vitamin E supplementation and its effects in reducing exercise induced peroxidative damage

Fat Soluble Vitamins – Requirements and Sources

- Vitamin A
 - 700-900 micrograms/day
 - Retinol
 - Liver, egg yolks, fortified dairy products, margarine, fish oil
 - Beta Carotene
 - Red, orange, yellow and dark green fruits and vegetables
- Vitamin D
 - 5-15 micrograms/day
 - Sunlight
 - Eggs, fortified milk, liver, butter, margarine

Fat Soluble Vitamins – Requirements and Sources

- Vitamin E
 - 15 milligrams/day
 - Green leafy vegetables, vegetable oils, seeds, nuts, liver and corn
- Vitamin K
 - 90-120 micrograms/day
 - Green leafy vegetables, cereals, fruits and meats
 - Bacteria in human large intestine can synthesize Vitamin K

Major Minerals

- Calcium
- Phosphorus
- Magnesium
- Sodium
- Chloride
- Potassium

Major Minerals – General Functions

- Structure
- Muscle contraction
- Energy metabolism
- Fluid balance
- Blood clotting
- Nerve impulse transmission

Major Minerals – Special Considerations in Runners

- Calcium deficiency may lead to increased risk and occurrence of stress fractures
- Sodium prevalent in sports drinks because it helps maintain blood volume, which is important in athletic performance – related to ability to deliver nutrients to cells, remove metabolic by-products from cells and maintain sweat rate
- Sodium deficiency may lead to hyponatremia
 - Muscle cramping, nausea, vomiting, seizures, coma
 - Commonly results from the production of a large volume of sweat and consumption of replacement fluid that has an inadequate concentration of sodium

Major Minerals – Requirements and Sources

- Calcium
 - 1300-1500 milligrams/day
 - Dairy products, dark green leafy vegetables, dried beans and peas
- Phosphorus
 - 1250-1500 milligrams/day
 - Protein rich foods and cereal grains
- Magnesium
 - 400-450 milligrams/day
 - Milk and milk products, meats, nuts, whole grains, dark green leafy vegetables, fruits

Major Minerals – Requirements and Sources

- Sodium
 - More than 1.5 grams/day
 - High sweat losses may increase requirement to more than 10g/day
 - Processed, canned and fast foods
- Chloride
 - 2.3 grams/day
 - Table salt
- Potassium
 - 4.7 grams/day or more with high levels of sweat loss
 - Fresh fruits and vegetables

Trace Minerals

- Iron
- Zinc
- Iodine
- Selenium
- Copper
- Manganese
- Chromium

Trace Minerals – General Functions

- Formation of hemoglobin and myoglobin
- Energy metabolism, particularly carbohydrate metabolism and glucose use
- Wound healing
- Carbon dioxide removal
- Antioxidant
- Regulation of metabolic rate, growth and development
- Structure
- Immune function

Trace Minerals – Special Considerations in Runners

- Iron deficiency anemia is characterized by poor oxygen carrying capacity that causes endurance problems in athletes
- Careful monitoring of iron intake for vegetarians
- Intravascular hemolysis
 - Shortened lifespan of red blood cells in athletes
- Zinc deficiency can slow wound healing and weaken the immune system

Trace Minerals – Special Considerations in Runners

- Selenium deficiency may result in muscle weakness and increased recovery time after exhaustive exercise
- Copper deficiency associated with failure to use iron in the formation of hemoglobin and myoglobin
- Chromium deficiency associated with poor blood glucose maintenance

Trace Minerals – Requirements and Sources

- Iron
 - 15-18 milligrams/day
 - Meats, eggs, vegetables and iron fortified cereals
- Zinc
 - 12-15 milligrams/day
 - Meat, liver, eggs, seafood
- Iodine
 - 120-150 micrograms/day
 - Iodized salt

Trace Minerals – Requirements and Sources

- Selenium
 - 50-55 micrograms/day
 - Meat, fish, seafood, whole grain foods, nuts
- Copper
 - 900 micrograms/day
 - Shellfish, soybean products, legumes, nuts, seeds, liver and potatoes
- Manganese
 - 2.0-2.5 milligrams/day
 - Coffee, tea, chocolate, whole grains, nuts, seeds, soybeans, dried beans, liver and fruits

Trace Minerals – Requirements and Sources

- Chromium
 - 30-35 micrograms/day
 - Whole grain breads, cereals and meats

Fueling Strategies

- Training must include nutrition
 - Any recommendations regarding pre-exercise eating should be pondered and experimented with during long runs, not on race day
- Eat even sized meals about every four hours, starting with breakfast within three hours of waking
 - Make sure to consume enough calories and the appropriate balance of nutrients



Fueling Strategies

- Pre-exercise
 - Digestion rates
 - 3-4 hours to digest large meal
 - 2-3 hours to digest small meal
 - 1-2 hours to digest blended or liquid meal
 - Less than one hour to digest small snack
 - Carbohydrate rich foods
 - 25 – 75 grams (100 – 300 calories) of carbohydrate
 - Avoid lots of fiber and fructose
 - Avoid foods high in protein and fat
 - Long gastric emptying time



Fueling Strategies



- During exercise
 - Consume glucose during activities greater than 60-90 minutes
 - 30 – 60 grams (120-240 calories) of carbohydrate per hour of activity

Fueling Strategies



- Post-exercise
 - You have not finished training until you have refueled
 - The sooner you refuel, the sooner your muscles have the tools necessary to recover
 - 50-100 grams (200-400 calories) of carbohydrate
 - 10 grams (40 calories) of protein

The Oil - Fluids

- Water
- Sports drinks



Water - Functions

- Main component of blood
 - Delivers oxygen, nutrients, hormones and other substances to cells
 - Removes metabolic wastes from cells
- Temperature regulation
- Regulation of fluid balance in and out of cells

Sports Drinks - Functions

- Contain carbohydrates, electrolytes and water important for training sessions greater than 60-90 minutes

Fluid - Special Considerations Important in Runners

- Sweat production is one of the main mechanisms for the body to dissipate heat produced during physical activity
- Factors affecting fluid loss
 - High temperature and humidity
 - Clothing that traps sweat against the skin
 - Large body surfaces
 - Well conditioned athletes
 - Hydration status

Fluid - Special Considerations Important in Runners

■ Thirst

- Poor indicator of fluid needs in athletes
 - Nearly 10% decrease in blood volume is required to stimulate thirst
- No hope of athlete returning to adequately hydrated state during exercise if fluid consumption begins at the same time as the thirst sensation occurs

Fluid - Special Considerations Important in Runners

■ Dehydration

- Signs
 - Thirst
 - Low quantity and dark colored urine
- Results
 - Heat cramps
 - Heat exhaustion
 - Heat stroke
 - Hyponatremia

Hydration Strategies

■ Pre-exercise

- About 3 to 4 hours before training, consume 16-24 ounces of fluid
- About 15 minutes before training, consume 8 ounces of fluid

■ During exercise

- 6-8 ounces of fluid every 30-35 minutes
- Should contain carbohydrate

■ Post-exercise

- 16-24 ounces for every pound lost during training
- Should contain both carbohydrate and sodium

THE BIG RACE!

■ Prior to the race

- 300-500 calories 3 hours before a half marathon or marathon
- 100-150 calories of sports drink an hour prior to event
- Shorter races – fewer calories

■ During the race

- 6-8 ounces sports drink every 30-35 minutes or 20-30 minutes in warm temperatures

■ After the race

- Replenish fuel and hydrate as described earlier – the sooner the better!

So which car will you be???



OR



References

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