Optimal DIETARY Intake

...THE BASICS

FOR SPORT.

FOR LIFE.

USADA

U.S. Anti-Doping Agency

CONTENTS

THE PURPOSE OF THIS MODULE

This publication provides general guidelines to help optimize dietary intake for sports competitors. Dietary intake requirements can vary depending upon an individual's energy expenditure, metabolism, state of health, etc. Future materials related to sport nutrition will include topics such as special needs for endurance and ultra endurance sports, and nutrition tips when competing in other countries.

Now more than ever, athletes need accurate sports nutrition information. Optimal nutrition is an integral part of peak performance while an inadequate diet and lack of fuel can limit an athlete's potential for maximum performance. Unfortunately, there is much misinformation available regarding a proper diet for athletes. In the quest for success, many athletes will try any dietary regimen or nutritional supplementation promising a new level of physical performance. However, most often an evaluation and modification of current dietary intake is needed to help maximize peak performance. >>>

The human body must be supplied continuously with energy to perform its many complex functions. As an athlete's training and competition level increases, the body's energy demands also increase. Several energy systems in the body can provide athletes with fuel as long as they are consuming the proper foods. One energy system relies totally on carbohydrates while another uses carbohydrates as well as fats. When an athlete works near or at maximal intensities, carbohydrates are the only fuel the body can use. During prolonged exercise such as cycling, triathlons, and long-distance swimming, the amounts of fat and carbohydrate used may rise and fall depending upon:

- Duration and intensity of the exercise;
- An individual's fitness level; and
- Food and drink consumed prior to and during the exercise.

CARBOHYDRATES- THE MASTER FUEL

A diet rich in carbohydrates increases endurance performance because of the extra store of carbohydrates in the muscles called glycogen. Work completed in the early 1980's by David Costill at Ball State University showed that if athletes did not consume a diet high in carbohydrates on a daily basis, they would experience chronic fatigue and poor performance. It is well documented that endurance athletes need to replenish carbohydrate stores in the body. Several recent studies have shown that athletes who participate in stop-and-go sports, such as basketball and soccer, may also need to focus on consuming more carbohydrates. Athletes doing stop and go activities were found to have better speeds and to delay fatigue when consuming a higher carbohydrate diet.

Recommended Intake of Carbohydrates

Depending upon the training routine, athletes need to consume at least 50%, but ideally 60-70% of their total calories from carbohydrates. This percentage is only a guideline for estimating carbohydrate needs. Depending upon the length of training sessions, an athlete's carbohydrate intake should be between 2.5-6.0 grams per pound of body weight, with longer training times requiring the higher number of grams. See the table below to calculate grams of carbohydrate needed.

TABLE 1. **DETERMINING GRAMS OF CARBOHYDRATE FOR ATHLETES' NEEDS**

The following example shows how to calculate the recommended grams of carbohydrate needed per pound of body weight.

WEIGHT IN POUNDS		CARBOHYDRATES IN GRAMS		DAILY CARBOHYDRATE INTAKE
160	x	2.5	=	400 grams

Now calculate your own needs. Remember to multiply your body weight by a higher number of carbohydrate grams for lengthier or multiple bouts of training. For example, an hour of training per day may indicate using 2.5 grams in your calculation, and training four or more hours per day may indicate using 6.0 grams.

WEIGHT IN POUNDS		CARBOHYDRATES IN GRAMS		DAILY CARBOHYDRATE INTAKE
	x		=	

Carbohydrate Intake Before, During and After Exercise

BEFORE EXERCISE:

The pre-exercise or pre-training meal serves two purposes:

- It keeps the athlete from feeling hungry before and during exercise, and
- It maintains optimal levels of energy for the exercising muscles.

Athletes who train early in the morning, before eating or drinking, risk developing low glycogen stores and a sub-par performance as well.

Carbohydrate intake before exercise can help to restore sub-optimal glycogen stores. While allowing for personal preferences and psychological factors, the pre-event meal should be high in carbohydrates, non-greasy and readily digestible. Fatty foods should be limited as they delay the emptying time of the stomach and take longer to digest. The following are guidelines for the pre-event meal:

- It should be eaten 3-4 hours before an event.
- The meal should provide 150-350 grams of carbohydrate (1.5 grams per pound of body weight).

- To avoid stomach upset, the carbohydrate content of the meals should be reduced the closer the meal is to the event.

[*For example, four hours before the event, it is suggested that the athlete consume 1.5 grams of carbohydrate per pound of body weight, whereas one hour before the competition, the athlete would consume 0.5 grams of carbohydrate per pound of body weight.*] *(See Table 2)*

TABLE 2. **SUGGESTED MEALS FOR PRE-EVENT EATING**

1 HOUR OR LESS	*SERVING SIZE*	*GRAMS OF CARBOHYDRATES*
1/2 Bagel	2 oz	26 g
Banana	7 oz	30.6 g
Toast	1 slice	14 g
Food bar	1 bar	47 g
Crackers	5 crackers	10 g
Fluid replacement drink	8 oz	14 g
Pretzels	20 pieces	22 g
Raisins	small box (2.5 oz)	34 g
Graham crackers	8 crackers	25 g
Applesauce	4 oz	14 g
Fig bar	1 oz	20 g

(Table continued on page 6)

TABLE 2. **SUGGESTED MEALS FOR PRE-EVENT EATING** (CONTINUED FROM PAGE 5)

2-3 HOURS BEFORE	*SERVING SIZE*	*GRAMS OF CARBOHYDRATES*
Oatmeal (instant)/ lowfat milk (1%)	2 oz oatmeal 4 oz milk	oatmeal: 25.7 g milk: 7.9 g
Cereal (whole grain)/ lowfat milk	1 oz cereal 4 oz milk	cereal: 47 g milk: 7.9 g
Fresh fruit (chopped apple)	8 oz	19.1 g
Pancakes/waffles (from mix)	2.5 oz (5" diameter)	20.1 g
Yogurt	8 oz	33 g
Bagel (whole grain) with peanut butter	1 bagel (4 oz) 2 tbsp peanut butter	bagel: 47 g peanut butter: 7 g
Fluid replacement drink	8 oz	14 g
Food bar (oatmeal raisin walnut)	1 bar	43 g
String cheese	1 oz	<1 g
Fruit smoothie	12 fl oz	46.5 g
Baked potato (plain)	7 oz	58.1 g

4 OR MORE HOURS BEFORE	*SERVING SIZE*	*GRAMS OF CARBOHYDRATES*
Grilled chicken/ rice (white)/ fruit (chopped apple)	chicken: 3.2 oz rice: 5.5 oz fruit: 4.5 oz	chicken: 0 g rice: 44.4 g fruit: 19.1 g
Turkey sandwich (w/3 slices deli meat, 2 slices whole wheat bread low-fat mayo)/baby carrots	turkey: 1 slice mayo: 1 tbsp bread: 1 slice 7 carrots	turkey: 0 g per slice mayo: 1 g bread: 11.8 g per slice carrots: 2.3 g
Spaghetti with meat sauce	12 oz	84 g
Trail mix with nuts/raisins	1.1 oz	11 g
Tuna sandwich (2 slices whole wheat bread)/ fat free mayo	tuna: 2 oz drained mayo: 1 tbsp bread: 1 slice	tuna: 0 g mayo: 2.5 g bread: 11.8 g per slice
String cheese/grapes/crackers	1 oz	<1 g
Fruit juice	8 oz	91.6 g
Food bar (oatmeal raisin walnut)/ Fluid replacement drinks	1 bar: 2.4 oz drink: 8 oz	bar: 43 g drink: 14 g
Liquid meal replacement	1 can (11 fl oz)	40 g

EATING AT ALL-DAY EVENTS:

It is important that athletes eat after competing to make sure that they will have enough energy in the muscles for the next day's competition. The same dietary intake principles used to plan the pre-exercise meal can also apply to foods eaten at all-day events. If an athlete races at 10:00 a.m. and again after two hours, foods that are high in protein and fat will more than likely still be in the stomach potentially causing stomach or gastrointestinal (GI) upset. The following guidelines have been recommended to help athletes make wise food choices at all-day events.

One hour or less between events or heats:

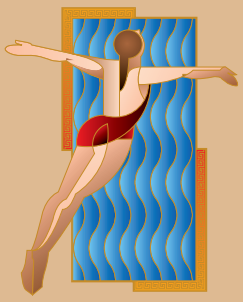
- Stick with carbohydrates that are in liquid form, such as juice.
- If something solid needs to be eaten, try fruits like oranges, watermelon, cantaloupe, peaches, pears or bananas.

These foods consist of mostly carbohydrates and water. They are digested very fast and therefore, will not cause as much of a problem with stomach cramping or GI distress.

Another key point to making food choices with limited time between events is *limiting the quantity of the food eaten.* The more an athlete eats, the longer it will take to digest, especially with any pre-competition nerves or stress.

Two to three hours between events or heats:

- Solid foods in the form of carbohydrates can be eaten, as there is enough time to digest them before competition.
- Try eating bagels, hot or cold cereal with low fat milk, or english muffins along with fruit like bananas, apples, oranges, peaches or pears.
- Be sure to drink plenty of fluids, like a fluid replacement drink, for hydration and restoration of glycogen stores.



FYI

(FOCUS on YOUR INTAKE)

It is best not to try different and new foods before an important competition. If an athlete is complaining of GI distress or stomach cramping, he or she should try different foods or use these guidelines.

Four or more hours between events or heats:

With four or more hours between heats or events, an athlete may want a meal, which should be composed primarily of carbohydrates. The following meal examples for this situation are appropriate:

- A turkey sandwich on two slices of whole wheat bread, low-fat yogurt, with fruit and a fluid replacement drink; or
- Spaghetti with meatballs, bread, salad with low-fat dressing and a fluid replacement drink.

If there is a certain meal pattern before competition that an athlete thinks is a winning combination, then they should stick to it.

Athletes who make food choices at concession stands need to know how to make the best choices. **Most concession stands are filled with high-fat, high-calorie foods that are not designed to maximize performance.** It is always wiser for athletes to pack a cooler from home with winning combinations than to rely on the food at a concession stand. Table 3 has a list of nutrient-dense foods that are easy to pack in a cooler and will help supply energy throughout the day.

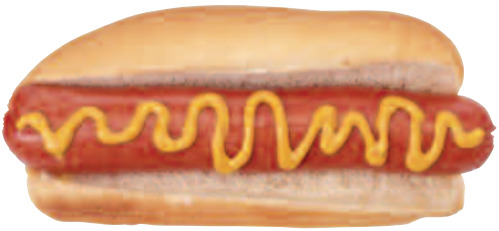


TABLE 3. **COOLER FUELERS**

FOOD	*SERVING SIZE*	*FAT*	*CARBOHYDRATES*	*PROTEIN*
Fluid replacement drinks	8 oz	0 g	14 g	0 g
Meal replacement drinks	1 can (11 fl oz)	3 g	40 g	10 g
String cheese	1 oz	6 g	<1 g	7 g
Yogurt	8 oz	0 g	15 g	11 g
Hard boiled eggs	1 large egg	5 g	1 g	6 g
Pita bread (whole wheat large pita)	1 pita	2 g	35 g	6 g
Whole grain cereal	4 oz	1 g	47 g	7 g
Granola bars	1 bar	3 g	18 g	6 g
Food bar (oatmeal raisin walnut)	1 bar	5 g	43 g	10 g
Fresh fruit	8 oz	.5 g	19.1 g	.3 g
Baby carrots	7 carrots	0 g	1 g	0 g
Celery	1 large stalk	0 g	2 g	0 g
Cherry tomatoes	5 oz	0 g	7 g	1 g
Whole grain bagel	1 bagel (4 oz)	1.5 g	47 g	11 g
Breadsticks	1 stick (2 oz)	6 g	24 g	4 g
Turkey sandwich (3 slices deli meat, 2 slices whole wheatbread, low-fat mayo)/ baby carrots	turkey: 1 slice mayo: 1 tbsp bread: 1 slice 7 carrots	turkey: .3 g per slice mayo: 5 g bread: 2.3 g per slice carrots: 0 g	turkey: 0 g per slice mayo: 1 g bread: 11.8 g per slice carrots: 2.3 g	turkey: 4.7 g per slice mayo: 0 g bread: 1 g per slice carrots: <1 g
Ginger snaps	1 oz	3 g	22 g	2 g
Vanilla wafers	4 wafers	10 g	19 g	<1 g
Whole grain crackers	5 crackers	15 g	11 g	1 g
Dried fruit	1 package	1 g	188 g	7 g
Peanut butter	2 tbsp	16 g	7 g	8 g
Nuts (mixed)	1 oz	14.6 g	7.2 g	4.9 g
Cottage cheese	8oz	4 g	8 g	24 g

DURING EXERCISE:

Carbohydrate consumed during exercise lasting longer than 45 minutes ensures that the muscles require adequate amounts of energy, especially during the later stages of the competition or workout. It has also been found to improve performance. The form of carbohydrate does not matter. Some athletes prefer to use a fluid replacement drink, whereas others prefer to eat solid or gel forms of carbohydrates. Use the following guidelines when consuming fluid replacement drinks with carbohydrates:

- Choose drinks that have a carbohydrate concentration between 6-8% (see Table 4), these can be consumed every 15-20 minutes.
- It is unlikely that a carbohydrate concentration of less than 5% is enough to help performance.
- Drinks with a concentration greater than 10% are often associated with abdominal cramps, nausea and diarrhea (see Table 5).

Note: Fluid replacement drinks should not be confused with "energy" drinks. Energy drinks typically contain one or more stimulants.

TABLE 4. **CALCULATING CARBOHYDRATE CONCENTRATIONS IN BEVERAGES**

To assess the concentration of a fluid replacement drink or any beverage, use the following calculations:

$$\frac{\textbf{AMOUNT OF CARBOHYDRATE IN GRAMS (FROM THE LABEL)}}{\textbf{THE VOLUME IN ONE SERVING (USE 240 ml PER CUP)}} \times 100 = \textbf{PERCENTAGE}$$

Example: $\frac{\textbf{15 GRAMS}}{\textbf{240 ml}} = .625 \times 100 = 6\%$

TABLE 5. **CARBOHYDRATE (CHO) CONCENTRATIONS OF VARIOUS BEVERAGES**

EXAMPLES OF FLUID REPLACEMENT DRINKS*

BEVERAGE	CHO CONCENTRATION	ELECTROLYTES
Gatorade	6%	Proper concentration
Powerade	7%	Low Sodium, High Potassium
AllSport	8%	Low Sodium, High Potassium
Met-Rx ORS	8%	High Sodium, High Potassium
PowerBar Perform	7%	High Sodium, High Potassium
Revenge	4%	Low Sodium, High Potassium

** Taken from labels on each example*

EXAMPLES OF OTHER BEVERAGES

BEVERAGE	CHO CONCENTRATION	ELECTROLYTES
Soda pop	10-12%	Low Sodium, Low Potassium
Endurox	15%	High Sodium, High Potassium
Orange juice	11%	Low Sodium, Very High Potassium
Rehydralyte	2.5%	Very High Sodium and Potassium

AFTER EXERCISE:

Delaying carbohydrate intake after exercise will reduce muscle glycogen stores and impair the ability of the muscles to recover. There are several research studies that show that consuming carbohydrates immediately after exercise is beneficial. Other points about post-exercise carbohydrate consumption are that:

- Carbohydrates promote the muscles to take up more glycogen, thus reloading the athlete faster. This is important to minimize fatigue associated with repeated days of heavy training or tournament play in which several games are played over one or two days.
- The recommendation is 0.65 grams of carbohydrate per pound of body weight consumed within 30 minutes after exercise. This should be followed by an additional carbohydrate meal two hours later.
- The first feeding can be a high carbohydrate beverage, followed by eating a high carbohydrate meal. Table 6 gives examples of meals immediately after exercise and two hours later.

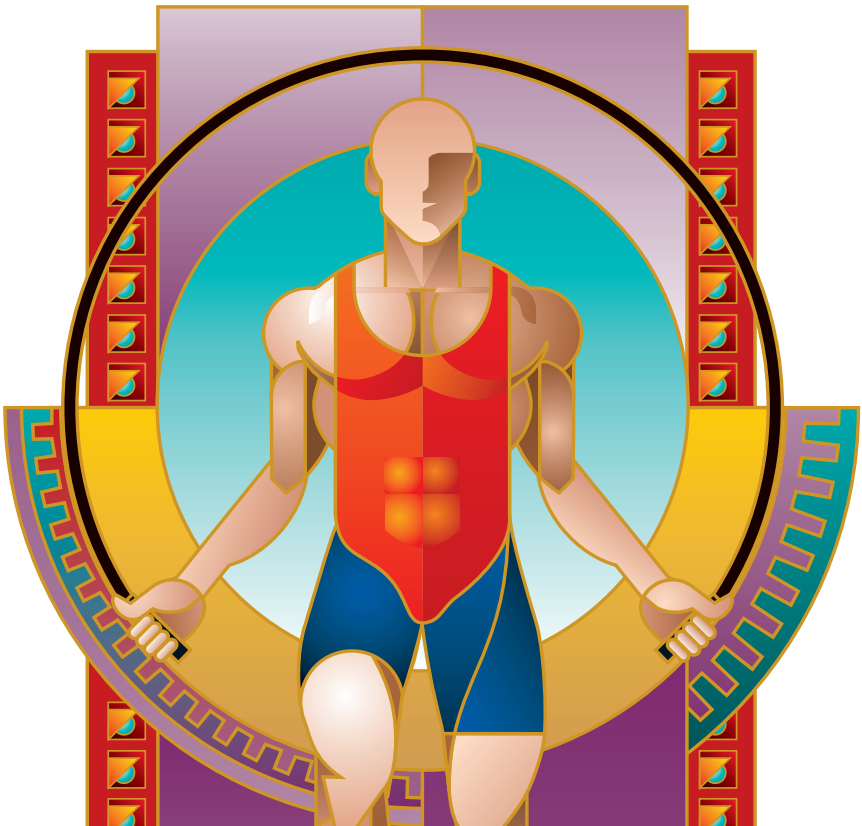
TABLE 6. **RECOVERY MEALS AFTER EXERCISE**

To completely refill energy in the muscle, eat within 30 minutes after exercise and then eat small meals two hours and again at four hours after the workout.

Choose high-carbohydrate foods such as bagels, pasta, fruits, vegetables, yogurts, cereal with low-fat milk, toast and peanut butter, fluid replacement drinks, food bars, french toast, sub sandwiches, baked potatoes with chili, smoothie made with fruit, fruit juice, yogurt, and frozen yogurt.

If you can't consume solid foods 30 minutes after exercise, try 2-4 cups of a fluid replacement drink, or a food bar, and incorporate solid foods two and four hours after exercise.

Be sure to hydrate after a workout or game. Drink 3 cups of fluid for each pound lost during the competition.



PROTEIN'S ROLE AS A TEAM PLAYER

Protein has always been a particularly popular nutrient with athletes because of its role in building and maintaining muscles. While protein is necessary, it is not the primary fuel for working muscles. Athletes need to consume a wide variety of high-quality protein foods in their diet. However, consuming more protein than the body can use is not going to give athletes larger and stronger muscles. Research shows that protein requirements may be higher for athletes. However, most athletes are already consuming more protein than the body can process. Use the following formulas as guidelines to ensure proper amounts of protein are included in your dietary intake.

TABLE 7. **DAILY PROTEIN RECOMMENDATIONS**

TYPE OF TRAINING TRAINING	***GRAMS (g) OF PROTEIN RECOMMENDED***
Endurance	0.54-0.64 g of protein per pound of body weight
Strength (to gain muscle mass)	0.72-0.81 g of protein per pound of body weight
Strength (maintenance)	0.54-0.64 g of protein per pound of body weight
Weight Restricted	0.63-0.81 g of protein per pound of body weight

To calculate protein requirements per pound of body weight, use Table 8.

TABLE 8. **PROTEIN REQUIREMENTS IN GRAMS PER POUND OF BODY WEIGHT**

To calculate the amount of protein your body needs on a daily basis, simply take your body weight in pounds and multiple it by the appropriate recommendation. For example, the range of protein for a 185-pound soccer player is 100-118 grams daily.

WEIGHT IN POUNDS		PROTEIN IN GRAMS		DAILY PROTEIN INTAKE
185	x	0.54	=	100 g
185	x	0.64	=	118 g

Calculate your own protein needs. Refer to Table 7 to get the recommended grams of protein for your type of training, and calculate both the low and the high values to get a range of appropriate protein for a daily intake.

WEIGHT IN POUNDS		PROTEIN IN GRAMS		DAILY PROTEIN INTAKE
	x		=	
	x		=	

Table 9 provides additional information to translate this information into servings of protein-rich food.

TABLE 9. **PROTEIN CONTENT OF COMMONLY CONSUMED FOODS**

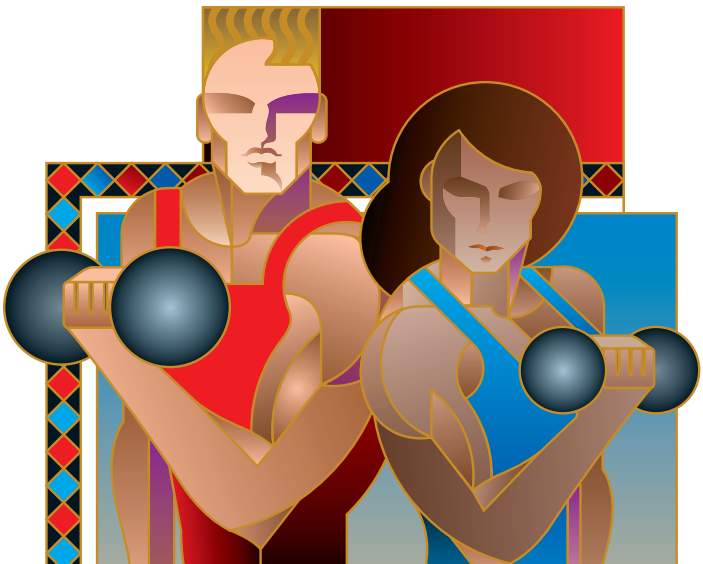
FOOD	SERVING SIZE	GRAMS OF PROTEIN
Ground beef	3.5 oz	24 g
Chicken breast	3.0 oz	25 g
Broiled fish	3 oz	20 g
Milk (all types)	8 fl oz	8 g
Egg	1 large or 2 egg whites	6.5 g
Whole wheat bread	1 slice	2.7 g
Tofu	4 oz	7 g
Peanut butter	2 tbsp	7 g
Mixed nuts	1 oz	4.9 g
Yogurt	8 oz	11 g
String cheese	1 oz	7 g
Cottage cheese	1/2 c	12 g

Building Body Mass

Many athletes want to add more bulk to their body in the form of lean muscle. Many supplement products claim to build muscles. Athletes should take special caution when considering supplementation (please see pages 19-23 for additional information and cautions). The dietary supplement industry is largely unregulated, and there is risk of products being contaminated with prohibited substances. Athletes should take special caution when considering supplementation. There is no guarantee that the product contents match with those listed on the label. Taking lots of extra protein either from supplements or food does not guarantee bigger muscles. If it did, athletes could spend time lounging instead of lifting to build muscles.

A healthier regimen for building muscles would include:

- Following a strength training program that challenges muscles.
- Adding 500 to 1,000 more calories each day to current dietary intake.
- Eating foods that are both high in carbohydrates and proteins like grilled chicken sandwiches, peanut butter sandwiches, cheese and crackers.
- Choosing low-fat sources of both carbohydrate and protein.
- Eating several small meals throughout the day to support training and muscle-building.



Protein After Exercise

The body's ability to recover from games, practices or intense workouts requires adequate rest and proper nutrition. An important component of the recovery process is consuming carbohydrate shortly after exercise, which facilitates the restoration of muscle glycogen (stored carbohydrate energy). Some believe that a mixture of carbohydrate and protein will speed up this process, but that contention is not supported by science.

Keep in mind that food is fuel and athletes should not come to practice or games without having had enough food to support the energy requirements for their sport. To keep athletes properly fueled and have protein needs met, use the **EAT guidelines:**

EAT BREAKFAST. It is the best way to start the day well fueled. Include foods that contain carbohydrates and protein such as low-fat milk, yogurt, or an egg.

ADD CARBOHYDRATE AND PROTEIN TO POST-EXERCISE MEALS. Some energy bars provide carbohydrates to replenish the muscle glycogen stores and protein to help build and repair muscles.

TOSS THE SUPPLEMENTS. Athletes should rely on protein from food sources first, instead of supplements. This helps ensure that diets are balanced for health and performance.

FYI

(FOCUS on YOUR INTAKE)

Carefully controlled studies have shown that adding protein, amino acids or protein powders to a carbohydrate supplement is no more effective for muscle glycogen re-synthesis than ingesting equal calories of carbohydrate alone.

DIETARY FAT

Fat Intake In Athletes

Fat is the major if not most important fuel for light to moderate intensity exercise. Although fat is a valuable metabolic fuel for muscles during endurance exercise and performs many important functions in the body, no attempt should be made to consume more fat. In addition, athletes that consume high-fat diets typically consume fewer calories from carbohydrates.

A recent study looked at muscle biopsies of elite rowers who consumed either 40% of their calories from fat or 20% of their calories from fat, and also compared the power output and speed of the rowers. The following is a summary of the results:

- The rowers who consumed the low-fat, high-carbohydrate diet had more muscle glycogen.
- The rowers on the high-fat, low-carbohydrate diet had moderate levels of muscle glycogen but were still able to complete the workout sets.
- When it came to power output and faster speeds, those rowers who consumed the low-fat, high-carbohydrate diets had significantly higher power and speed.

This has significant implications for athletes in muscular endurance sports that require a burst of power, such as rowing, swimming, gymnastics, figure skating, judo, boxing, baseball, basketball or soccer, to have energy generated aerobically.

It is important to recognize that there are many sources of hidden fat in foods. Fat is present, but not separately visible, in:

- Dairy products such as cheese, whole milk, sour cream and ice cream,
- Processed foods such as chips, crackers, granola bars and french fries, and
- Other food sources like nuts or avocados.

Other more obvious sources of fat are in products like margarine, butter, mayonnaise, salad dressing, oil and meats with marbling or visible fat.

Athletes should consume 20% to 30% of their calories from fat. Aside from decreasing overall calories, limiting consumption of dietary fat is the first step toward losing excess body fat. Doing so eliminates excess calories, but not nutrients. Following a low-fat, high-carbohydrate diet is also important for health reasons, because diets high in fat have been associated with cardiovascular disease, obesity, diabetes and some types of cancer. Table 10 gives suggestions for reducing fat intake.

TABLE 10. **SUBSTITUTIONS FOR REDUCING FAT INTAKE**

INSTEAD OF:	***TRY:***
Whole milk	Skim milk
Cheddar, jack or swiss cheese	Part-skim mozzarella, string or low-fat cottage cheese, other cheese that contain less than 5 grams of fat per ounce
Ice cream	Ice milk or low-fat/nonfat frozen yogurt
Butter or margarine	Jam, yogurt, ricotta cheese, light or nonfat cream cheese
Sour cream	Low-fat yogurt, light sour cream, blender whipped cottage cheese dressing
Bacon	Canadian bacon or bacon bits
Ground beef	Extra lean ground beef or ground turkey
Fried chicken	Baked chicken without the skin

(Table continued on next page)

INSTEAD OF:	*TRY:*
Doughnuts and pastries	Bagels, whole-grain breads, homemade breads, low-fat muffins and quick breads
Apple Pie	Baked or raw apple
Chocolate candy or bars	Jelly beans, hard candy, licorice
Cookies, cakes, brownies	Vanilla wafers, ginger snaps, graham crackers, fig bars

VITAMINS AND MINERALS

Many athletes may turn to vitamin and mineral supplementation due to confusion over the recommended daily allowance (RDA), or the dietary reference table (DRI).

Dietary supplements are defined as products containing "dietary ingredients" intended to supplement the diet. These include vitamins, minerals, amino acids, botanicals, herbs, and substances such as enzymes, organ tissues and glandulars, metabolites, and other dietary supplements.

The question that arises is "do most athletes need to take dietary supplements?" The answer to that question generally is no. Most sports medicine professionals agree that unless an individual has a nutrient deficiency, supplementation may not improve athletic performance.
The athlete who takes a simple one-a-day type of vitamin or mineral that does not exceed the nutrient levels of the RDA/DRI is probably not doing any harm. An athlete should consult with his or her physician, or other health care professional, to determine whether vitamin and mineral supplementation is needed to maintain optimal health.

TABLE 11. 1989 RECOMMENDED DIETARY ALLOWANCES (RDA)

	AGE (YR)	(kcal) ENERGY	(g) PROTEIN	(mg RE) VITAMIN A	(mg α-TE) VITAMIN E	(µg) VITAMIN K	(mg) VITAMIN C	(mg) THIAMIN	(mg) RIBOFLAVIN	(mg NE) NIACIN	(mg) VITAMIN B_6	(µg) FOLATE	(µg) VITAMIN B_{12}	(mg) IRON	(mg) ZINC	(µg) IODINE	(µg) SELENIUM
Males	15-18	3000	59	1000	10	65	60	1.5	1.8	20	2.0	200	2.0	12	15	150	5
	19-24	2900	58	1000	10	70	60	1.5	1.7	19	2.0	200	2.0	10	15	150	70
	25-50	2900	63	1000	10	80	60	1.5	1.7	19	2.0	200	2.0	10	15	150	70
Females	15-18	2200	44	800	8	55	60	1.1	1.3	15	1.5	180	2.0	15	12	150	50
	19-24	2200	46	800	8	60	60	1.1	1.3	15	1.6	180	2.0	15	12	150	55
	25-50	2200	50	800	8	65	60	1.1	1.3	15	1.6	180	2.0	15	12	150	55

Source: RDA was adapted and reprinted with permission from *Recommended Dietary Allowances,* 10th edition © 1989 by the National Academy of Sciences. Courtesy of the National Academy Press. Washington, D.C.: Committee on Dietary Reference Intakes,, *Dietary Reference Intakes for Calcium, Phosphorus, Magnesium, Vitamin D, and Fluoride* (Washington, D.C.: National Academy Press, 1997).

EXAMPLES OF FOODS RELATED TO RDA AND DRI

PROTEIN
Asparagus
Beef
Beans (black/pinto/lima/kidney)
Chicken breast
Salmon (baked or broiled)
Tuna (baked or broiled)
Turkey breast

VITAMIN A
Bell peppers (raw)
Cantaloupe
Eggs
Liver
Raw carrots
Spinach
Sweet potatoes

VITAMIN E
Eggs
Fruit
Leafy green vegetables (spinach)
Meats
Nuts
Poultry

VITAMIN K
Asparagus
Cauliflower
Dairy products
Leafy green vegetables (spinach)
Peas
Wheat

VITAMIN C
Apples
Asparagus
Broccoli
Citrus fruits
Melons
Potatoes
Spinach
Tomatoes

THIAMIN
Beef
Legumes (beans, lentils)
Milk
Nuts
Oats
Pork
Whole grain cereals

RIBOFLAVIN
Dairy products (milk, eggs)
Green vegetables (spinach, broccoli)
Liver
Meats

NIACIN
Green vegetables (asparagus, broccoli)
Cereal grains
Meats
Liver
Fish
Dairy products (milk, eggs)

VITAMIN B_6
Carrots
Cereal grains
Dairy products (milk, cheese)
Fish
Legumes (beans, lentils)
Liver
Peas
Potatoes
Spinach

FOLATE
Asparagus
Beans (pinto/black/garbanzo/kidney)
Broccoli
Liver
Melons
Okra
Spinach

VITAMIN B_{12}
Dairy products
Fish
Hard boiled eggs
Liver
Meats
Milk
Shellfish

IRON
Fish
Grain products
Leafy green vegetables
Legumes (beans, lentils)
Meat
Nuts
Poultry
Strawberries

ZINC
Beans
Fish
Lean red meats
Liver
Oysters
Peas

IODINE
Milk
Seaweed
Tuna

SELENIUM
Butter
Fish
Garlic
Nuts
Raisins
Shellfish
Sunflower seeds
Wheat

VITAMIN D
Cod liver oil
Eggs
Exposure to the sun
Fish
Fortified milk

CALCIUM
Dairy products (milk, cheese)
Salmon
Shrimp
Tofu
Yogurt

PHOSPHORUS
Dairy products (milk, cheese)
Dried beans
Fish
Meats
Nuts
Peanut butter

MAGNESIUM
Beans
Leafy green vegetables
Nuts
Peas

FLUORIDE
Drinking water
Fish (including bones - sardines)
Tea

An athlete who replaces food with supplements can put his or her health at risk. A handful of supplements for breakfast, followed by several tablespoons of assorted products containing trace minerals or powdered

1997 DIETARY REFERENCE INTAKES (DRI)

	AGE (YR)	(µg) VITAMIN D	(mg) CALCIUM	(mg) PHOSPHORUS	(mg) MAGNESIUM	(mg) FLUORIDE
Males	14-18	5	1300	1250	410	3.2
	19-30	5	1000	700	400	3.8
	31-50	5	1000	700	420	3.8
Females	14-18	5	1300	1250	360	2.9
	19-30	5	1000	700	310	3.1
	31-50	5	1000	700	320	3.1

ATHLETES SHOULD NOTE THAT : *THE USE OF NUTRITIONAL OR DIETARY SUPPLEMENTS IS COMPLETELY AT THE ATHLETE'S OWN RISK. EVEN IF THE SUPPLEMENTS ARE "APPROVED" OR "VERIFIED".*

Athletes taking nutritional or dietary supplements may test positive for a prohibited substance which is not disclosed on the product label. Sanctions are imposed in accordance with applicable rules for all positive test results.

USADA understands that some trade associations and reputable companies are attempting to test supplements and even are "verifying" or "certifying" that certain nutritional or dietary supplements are safe for athletes and others to use. Athletes need to be aware that these verification or certification programs do not guarantee that those dietary or nutritional supplements are free from prohibited substances which can cause an athlete to test positive. ***Bottom Line: USADA warns against taking any dietary or nutritional supplements. Athletes who take dietary or nutritional supplements, even if "approved" or "verified," do so at their own risk.***

protein supplements and herbs throughout the day, will not provide the health benefits and needs found in food.

Self-prescribed supplement users should heed overdose warnings, and look for symptoms of toxic levels of supplementation, such as diarrhea, skin rashes that do not fade, and unexplained joint pain. Fat soluble vitamins (A, D, E and K) can be toxic when misused. Unlike water soluble vitamins in which excess amounts are excreted in the urine, fat soluble vitamins are metabolized in body fat and remain in the body.

Remember that more is not always better. The established recommended dietary allowances (RDA) and dietary reference intake (RDI) for vitamins and minerals are to be used as a guide in determining nutritional needs. These allowances have a large margin of safety built into the recommendations. Even though it has been shown that a severely inadequate intake of certain vitamins and/or minerals can impair performance, it is unusual for an athlete to have such severe nutritional deficiencies. Even marginal deficiencies do not appear to markedly affect the ability to exercise efficiently.

Athletes searching for a competitive edge often look to a supplement or special combination of nutrients to find it. Research has shown, however, that there are no quick-fix supplements for improving sports performance. Consuming a wide variety of foods, and staying well hydrated are the basic cornerstones to reaching athletic potential.

Dietary Supplements and the Law

The increased visibility of many vitamins and minerals as well as herbal supplements, some argue, can be attributed to the passage of the Dietary Supplement Health and Education Act (DSHEA) in 1994. Under DSHEA, the Food and Drug Administration (FDA) no longer has regulatory control of supplements including vitamins, minerals, amino acids, herbals, and other botanical preparations.

Another interesting and somewhat controversial element of DSHEA allows manufacturers to publish limited information about the benefits of dietary supplements. This information is typically in the form of statements of support and claims about "structure and function." The result is a great deal of printed material where these dietary supplements are sold. Always remember that if something sounds too good to be true, it probably is.

Stimulant use has the potential for harmful effects. Ephedra, along with many other stimulants, are on the World Anti-Doping Agency's prohibited substance list in-competition. In light of many complaints about the adverse effects of ephedra and its alkaloids, including increased blood pressure, irregular heart rhythm and stroke, ephedra was banned by the Food and Drug Administration, effective April 12, 2004.

Central nervous system stimulants like ephedra, ma-huang, guarana and others have been marketed as having thermogenic effects. Thermogenic means "to produce heat" and is a term that describes many substances that are promoted as "fat burners" or providing "increased energy." Typically products promoted as such are a combination of two or more stimulants, such as caffeine, bitter orange, guarana, etc. While ephedra has gained the most notoriety there are several substances that have thermogenic effects, and consumers should be cautious.

The Anabolic Steroid Control Act Of 2004 (SB 2195) took effect on January 20, 2005. The Act classifies a number of pro-hormones or steroid precursors, previously manufactured as dietary supplements, as controlled substances, making it illegal without a medical prescription. According to the Act:

- Possession of a single pro-hormone tablet is punishable by up to a year in jail (even if the product was purchased prior to the change in the law);
- Distribution of these substances is a felony punishable by up to five years in prison for a first offense;
- A few of the most notable precursors identified in the Act include androstenedione, androstenediole and 4-hydroxy-19nortestosterone.

Anabolic steroids are a prohibited class of substances included on the World Anti-Doping Agency's List of Prohibited Substances.

For more information or a complete copy of the Anabolic Steroid Control Act, visit ***www.casper207.com***. You can find more information about dietary supplement warnings and the list of prohibited substances at ***www.usantidoping.org***.

Please note: USADA's Drug Reference Line™ and Drug Reference Online™ do not provide information about dietary supplements.

FYI (FOCUS on YOUR INTAKE)

Rolling the Dice. Under the DSHEA, dietary supplement manufacturers are not required to prove that products are safe or effective on human beings before being put on the market.

FLUIDS AND HYDRATION

Fluid replacement is probably the most important nutritional concern for an athlete. Approximately 60% of body weight is water. As an athlete trains or competes, fluid is lost through the skin through sweat and through the lungs while breathing. If this fluid is not replaced at regular intervals during practice or competition, it can lead to dehydration. A dehydrated athlete has a decreased volume of blood circulating through the body, and consequently:

- The amount of blood pumped with each heart beat decreases;
- Exercising muscles do not receive enough oxygen; and
- Exhaustion sets in and the athlete's performance suffers.

Research has repeatedly shown that dehydration, as little as 2% of body weight, can adversely affect athletic performance. For example, if a 150-pound athlete loses 3 pounds during a workout or competition, their ability to perform at peak performance due to dehydration is reduced. Proper fluid replenishment is the key to preventing dehydration and reducing the risk of heat-injury in athletes engaged in training and competition.

Preventing Dehydration

The best way to prevent dehydration is to maintain body fluid levels by consuming plenty of fluids before, during, and after a workout or competition. Often, athletes do not realize that they are losing body fluids or that they are impacting their performance through dehydration. Athletes who are not sure how much fluid to drink can monitor hydration using two helpful techniques:

- Weighing before and after practice. For every pound lost during the workout, drink three cups of fluid in order to rehydrate the body.
- Checking urine color. Urine that is dark gold in color indicates dehydration. Urine similar in color to pale lemonade or weak tea is a sign of a hydrated athlete.

Many times athletes wait to drink until they are thirsty. Thirst is not an accurate indicator of how much fluid an athlete has lost. Athletes who wait to replenish body fluids until feeling thirsty are already dehydrated. As a matter of fact, most individuals do not become thirsty until more than 2% of body weight is lost. Waiting until you are thirsty can affect your performance. When athletes only drink enough to quench their thirst, they may still be dehydrated. For best results, keep a bottle of fluid available when working out and drink as often as desired, ideally every 15-20 minutes. Table 12 lists guidelines for fluid replacement from the National Athletic Trainers Association, the American Dietetic Association and the American College of Sports Medicine.

TABLE 12. **GUIDELINES FOR PROPER HYDRATION**

- ***MONITOR FLUID LOSSES:*** Weigh-in before and after training, especially during hot weather and conditioning phase of the season
- ***FOR EACH POUND*** lost during exercise, drink three cups of fluid
- ***DO NOT RESTRICT*** fluids before, during or after the event
- ***DO NOT RELY*** on thirst as an indicator

What About Fluid Replacement Drinks?

It is now believed that fluid replacement drinks containing between 6-8% glucose or sucrose are absorbed into the body more rapidly than water, but unlike water, can provide energy to the working muscle that water cannot. A growing body of evidence suggests that consumption of a fluid replacement drink containing 6-8% carbohydrate can delay fatigue and possibly improve performance. It appears that athletes who consume a fluid replacement drink can maintain blood glucose levels at a time when muscle glycogen stores are diminished. This allows carbohydrate utilization and energy production to continue at high rates.

How Important are the Electrolytes Provided by the Fluid Replacement Drinks?

The ingestion of sodium during exercise may help with maintenance or restoration of plasma volume during exercise and recovery. The consumption of fluid replacement drinks containing sodium helps retain water in the body and aids in hydration by increasing the absorption of fluid from the intestines into the muscles. Recent research has suggested that a 6-8% carbohydrate sport drink with about 110 mg of sodium per eight ounce serving empties from the stomach just as fast as plain water.

There has been concern by parents, coaches and athletes that sports drinks may contain too much sodium. In fact many fluid replacement drinks are low in sodium (refer to Table 5 for examples). An eight ounce serving of a fluid replacement drink can have a sodium content similar to that of a cup of 2-percent milk. Most Americans consume too much sodium through processed and convenience foods, not through fluid replacement drinks.

The Ideal Fluid Replacement

The ideal fluid replacement beverage is one that tastes good, does not cause GI discomfort or distress when consumed in large volumes, promotes rapid fluid absorption and maintenance of body fluid, and provides energy to working muscles during intense training and competition.

Guidelines for Fluid Replacement

The following guidelines for maintaining body fluid balance, improving performance in the heat, and preventing heat-related illness appear to be prudent based on current scientific knowledge:

- For intense training and long workouts, a fluid replacement drink containing carbohydrates may provide an important source of energy. A 6-8% carbohydrate beverage is typically most effective in maintaining fluid balance while supplying the muscles with fuel.
- The fluid consumed during activity should contain a small amount of sodium and electrolytes. The sodium may be beneficial for quicker absorption.
- The beverage should be palatable and taste good.
- The athlete should drink 10-16 ounces of cold fluid about 15-30 minutes before workouts. If the workout is prolonged, add carbohydrates to the beverage at a 6-8% concentration.
- Drink 4-8 ounces of cold fluid during exercise at 15-20 minute intervals.
- Start drinking early in the workout because thirst does not develop until 2% of body weight has been lost, by which time performance may have begun to decline.
- **Avoid carbonated drinks,** which can cause GI distress and may decrease the volume of fluid consumed.
- **Avoid beverages containing caffeine, alcohol, and those promoted as "energy drinks."**
- If you have never used a fluid replacement drink, don't use it for the first time during a game or on race day. Practice consuming fluids while you train. Use a trial and error approach until you discover the fluid that works well for you.

BOTTOM LINE

Nutrition plays a critical role in athletic performance, and athletes, coaches, and parents need to realize that making wise food choices can increase the chances of optimal athletic performance. It is easy for athletes to fall prey to nutrition misinformation and fad diets in the search for a quick fix to improve performance. It is imperative that athletes stay current on the accurate nutrition issues as they are ever-changing. By making informed food choices athletes will have an advantage over those who choose to ignore the role that food plays in human performance.

Resources:

www.acsm.org American College of Sports Medicine

www.eatright.org American Dietetic Association

www.cfsan.fda.gov Center for Food Safety and Applied Nutrition - U.S. Food and Drug Administration

www.usda.gov/cnpp Center for Nutrition Policy and Promotion

www.healthierus.gov/dietaryguidelines Dietary Guidelines for Americans 2005

www.nutrition.gov National Agricultural Library, U.S. Department of Agriculture

www.drugfreesport.com/choices National Center for Drug-Free Sport

www.healthfinder.gov National Health Information Center - U.S. Department of Health & Human Services

www.win.niddk.nih.gov National Institutes of Health

www.nata.org National Athletic Trainers' Association

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Note: The content of this publication is provided for informational purposes only and is subject to change. This information is not intended to be a substitute for professional medical advice, diagnosis, or treatment. Individuals should always seek advice from a qualified health professional.

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