

# Fundamentals of Nutrition for Soccer

## Nutrition for Strength and Endurance

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### Introduction

The United States Surgeon General's 1988 report on nutrition and health, based on over 2,000 studies, concluded that illnesses of over eating and nutritional imbalance are the leading causes of death in North America. Numerous epidemiological studies point the link between diets high in saturated fats and cholesterol and increased risk for atherosclerosis and coronary heart disease. The "silent killer," or elevated blood pressure, has been linked to high sodium intake (some 20% of the US population is predisposed to retain sodium and as a result hold water), and it is believed that 30% - 50% of all cancer is diet related (Hoeger, 1991). In addition, poor nutritional habits may also lead to obesity, diabetes mellitus, and osteoporosis.

### General Guidelines for a Healthy Diet

The plethora of information about nutrition that is being promoted by various sources to the American consumer may have made it seem that eating a healthy diet is restrictive and complicated. Actually, developing healthy dietary habits is as simple as following the steps originally described in the United States Surgeon General's 1988 report on nutrition and health.

**(01)** Eat a variety of nutrients from the four food groups.\*

**A.** Consume four or more servings a day from the Beans, grains, & Nuts, and the Fruit & Vegetable groups.

**B.** Consume two servings a day from the Milk Products and the Poultry, Fish, Meat & Eggs groups.

**(02)** Eat foods high in starch (complex carbohydrates) and cellulose (indigestible fiber).

**(03)** Limit your total fat intake to 30% or below of your total daily caloric intake and keep your intake of saturated fats at or below 1/3 of you fat calories.

**(04)** Limit your cholesterol intake to 300 milligrams per day or less.

**(05)** Get your vitamins and minerals from the four food groups not from supplements.

**(06)** Avoid foods high in simple sugars.

**(07)** Limit sodium intake to no more than 2400 milligrams per day.

**(08)** Maintain an adequate intake of calcium.

**(09)** If you drink alcoholic beverages, keep it to no more than one or two drinks a day.

**(10)** Maintain your ideal lean vs. fat body weight.

\* The USDA redefined in 1991 the Four Basic Food Groups. The new order retained the four groups but put the emphasis on grains (6-11 servings), vegetables (3-5 servings), and lowered consumption recommendations for fruits (2-4 servings), milk products (2-3 servings), meat, poultry, fish, dry beans, eggs and nuts (2-3 servings), and fats, oils, and sweets (should be used sparingly).

Nutrients are chemicals that fulfill specific functions in the body. They provide energy, furnish structural components to construct body tissue, and supply regulators to control metabolic functions. Your local grocery store is the best source for the 37 (three macronutrients, 13 vitamins, and 21 minerals) essential nutrients needed by the body on a regular basis (Forsythe, 1990).

Williams (1988) has identified what he labeled as the ten "key nutrients" that are central to human nutrition (see Table 1.0 below). To help ensure that the established recommended daily allowance (RDA) of the macro-and micronutrients is consumed one must choose foods that have a high "nutrient density" or foods that are high in vitamins, minerals, and fiber but are low in calories.

## Table 1.0. Key Nutrients

Nutrient  
Plant Source  
Animal Source

### Carbohydrate

bread, cereals, pastas,  
fruits, and vegetables

### Protein

Dried beans, and peas & nuts  
Fish, Poultry, Meat, Milk & Cheese

### Fat

Margarine, Vegetable oils,  
Salad dressings  
Lard, Butter

### Vitamin A

Dark green, leafy vegetables,  
Yellow vegetables,  
Butter, fortified Milk, Liver, Margarine

### Vitamin C

Citrus fruits  
broccoli, potatoes,  
strawberries, tomatoes,  
cabbage, dark green leafy vegetables  
Liver

### Vitamin B1

(thiamin)  
Breads, Cereals, Nuts  
Pork, Ham

### Vitamin B2

(riboflavin)  
Breads, Cereals  
Milk, Cheese, Liver

### Niacin

Breads, Cereals,  
Nuts  
Fish, Poultry, Meat

### Iron

Dried peas and beans,  
Spinach, Asparagus  
Prune juice  
Meat, Liver

## Calcium

Turnip greens, okra  
Broccoli, spinach  
Milk, Cheese,  
Mackerel, Salmon

Adapted from Williams, M.H. (1988). *Nutrition for fitness and sport*. Dubuque, IA: Wm. C. Brown.

## Optimal Nutrition for Exercise and Sport

### Energy needs for sport and physical activity

Energy needs differ substantially among individuals. Factors, such as, age, gender, body surface area, and environment influence daily caloric output. Also, the number of calories burned in exercise fluctuates with the frequency, intensity, time, and type (FITT) of activity, movement efficiency, and status of physical fitness (Hecker, 1987). College athletes, for example, consume from 19.7 to 62.1 Kcal/kg. Thus a 120 kg (264 lbs) linesman may need as much as 7452 kcal/day to maintain his body weight. Hoeger (1991, p. 39) provides the following table for a quick appraisal of calorie needs by gender and activity level (see **Table 1.1**).

**Table 1.1. Caloric needs by gender and activity level**

	Calorie per pound	
	Men	Women
<b>Sedentary--Limited Physical Activity</b>	13.0	12.0
<b>Moderate Physical Activity</b>	15.0	13.5
<b>Hard Labor--Strenuous Physical Effort</b>	17.0	15.0

**\* Pregnant or lactating women add three calories to these values.**

## Complex Carbohydrates, Proteins, and Athletic Performance

Although the primary source of energy during endurance type exercise is derived from free fatty acids, carbohydrate, in the form of glycogen, is also needed. Several studies, that compared high fat or low carbohydrate diets to mixed or high carbohydrate diets, demonstrated a significant performance advantage to the high carbohydrate groups (Keith, 1989).

Consumption of adequate amounts of protein is crucial in order to increase muscle bulk. A normal diet that provides 15%-20% of calories in protein, however, seems to suffice. Very heavy exercisers may need additional 25 grams of protein for every additional 1000 Calories burned. Since athletes are high energy consumers (3500-6000 kcal), a diet consisting of 10% (350-600 kcal from PRO or 87.5-150 g of PRO) protein is often plentiful.

### VITAMINS, MINERALS AND ATHLETIC PERFORMANCE

There is absolutely no evidence that megadoses of vitamins and/or minerals improve performance. However, less than optimal levels of vitamins and minerals do hinder performance. Research has shown that athletes need and actually consume larger amounts of calories. Since a well balanced diet of 1200 Kcal will supply all the micronutrient needs of an adult, an athlete consuming a balanced daily diet of 3600-6000 Kcal will also ingest 3-5 times the RDA for vitamins and minerals! While it is relatively hard to vitamin or mineral overdose oneself through food consumption, it is fairly easy to achieve vitamin toxicity, for example, with the abuse of commercial vitamin pills (Aronson, 1986).

### WATER FOR MAXIMUM PERFORMANCE

A loss of water that exceeds 2 percent of one's body weight significantly impairs endurance performance. Therefore, it is recommended that exercisers drink lots of water, before, during, and after working out. After exercising in hot and humid environments for one hour a water loss of up to .5 lbs per mile may occur. To replace fluid loss under these conditions, an exerciser would have to drink one cup of water (8 oz) every mile or 6-8 minutes (Nieman, 1990). To systematically hydrate during exercise it is recommended to consume 200-400 ml of cold (40-50 F) every 15-20 minutes.

### Should electrolytes be used during soccer practice or a soccer match?

According to Nieman (1990), studies have demonstrated that losses of sodium, magnesium, calcium, zinc, and some vitamins through sweat are insignificant. Individuals engaging in very heavy exercise that lasts over four hours (Ironman triathletes & Ultra- marathoners), however, need fluids containing electrolytes.

### TIMING OF FOOD CONSUMPTION AND PERFORMANCE

**Pre-Event Feeding:** A diet high (65-70%) in complex carbo-hydrates consumed no later than 4-5 hours before competition appears to positively affect endurance type performance. The pre-event meal should not exceed 600 kcal and should be very light in fat (Keith, 1989).

**During Event Feeding:** Numerous studies compared the performance of endurance runners or cyclists when either a sport type drink and/or diluted sugary drink or plain water was consumed. Even though results consistently show that carbohydrate beverages outperform plain water, no practical benefits seem to result from carbohydrate ingestion throughout exercise. There is some evidence suggesting that large quantities of carbohydrates may make a difference if consumed approximately 30 minutes before fatigue starts (Nieman, 1990).

**Post-Event Feeding:** Ivy, Katz and others (1988) studied the effect of time of carbohydrate ingestion after exercise on muscle glycogen synthesis. They reported that a 23% solution of a carbohydrate drink, in a quantity that supplied two grams of carbohydrate per kilogram of body weight, led to a 300% increase in the rate of glycogen synthesis. Following Ivy and his colleagues' recommendation, soccer players may consume 1.5 g/kg body weight carbohydrates within the first 15-30 minutes after practice or a game. A second feeding should take place about one hour after the cessation of exercise.

### **SELECTING A WEIGHT CONTROL PROGRAM**

It is well established that fad diets don't work. If they did, most diet centers would have been out of business by now. As mentioned earlier, a well balanced diet of 1200 to 1500 kcal/day provides all the essential nutrients. Following the regiment of a healthy diet that supplies the macro- and micro- nutrients in proper amounts may be discouraging to some individuals since it is often associated with a lower weekly weight loss (1-2 lbs/week). On the other hand, extremely low calorie diets, restricting energy intake to 800 or less kcal/day may result in a substantial weekly weight loss (4-10 lbs). Very low calorie diets, that are not medically supervised, may cause the body to use up to 50% of its energy from muscle protein sources. Fat tissue is virtually water free while 80% of muscle tissue is water. Since one gram of fat yields ~9 kcal and one gram of "dry" protein yields ~4 kcal the energy stored in one pound of fat tissue and one pound of muscle tissue equals ~3500 kcal and ~350 kcal respectively. Thus, loss of protein weight could be as much as ten times faster than the loss of fat weight. While it may seem encouraging on the scale, remember that four-fifth of it will be water loss. In addition, a significant loss of lean body mass, a notable slowing of the Basal Metabolic Rate (BMR) as well as, malnutrition, that in extreme cases may result in death, are typical side effects of such drastic dieting practices. The typical scenario of crash diets includes the following stages: (a) at first, speedy weight loss, (b) consistent weight loss, (c) leveling off or plateauing of weight loss, and finally, (d) recovery of lost weight, often beyond the starting point. Every time an individual puts her/his body through a crash diet cycle the organism tends to become more metabolically efficient. The "Yo-Yo Diet Syndrome" best describes this pattern of quick loss of weight, and its speedy recovery and usually over compensation (Forsythe, 1990).

### **Commercial and fad diets that one should seriously question include diet systems that:**

Promise loss of a particular number of pounds, especially if it amounts to 2-5 times the recommended 1-2 lbs/ week.

Promote a particular type of food (e.g., rice, banana, grapefruit, yogurt etc.), especially if you can buy the food only from the specific diet system.

Presents itself as original, innovative, fast or easy--especially if it discredits scientifically well established nutrition facts (often will also include fanciful theories about "fat burning foods" and words like "cellulite").

Exclude one macronutrient, e.g., carbohydrate and promote another e.g., protein or fat.

Recommend less than 1200 kcal/day without the provision of trained medical supervision.

### **Points to look for in an advertised diet system:**

Does it emphasize high density low calorie foods?

Does it promote eating a variety of foods, and are those products available in your local grocery store?

Is it a system that you will be able to follow for a prolonged period of time (i.e., several years, or for the rest of your life)?

Is it a long term slow change system that results in a weight loss that does not exceed 1-2 lbs/week?

Is the modification of exercise and eating behaviors an integral part of the diet regimen?

Is it supervised and/or was it designed by properly trained nutritionists, dieticians, or physicians?

Does it include a weight maintenance program once the desired weight loss is achieved?

Can the organization provide you with information regarding dropout rates, long term success rates, and could you meet with individuals that completed the program a year or two ago?

## **FACTS AND FALLACIES ABOUT NUTRITION**

**The information provided below may be found in the following Health & Nutrition Letters:**

Harvard Health Letter

Harvard Women's Health Watch

Journal Watch (Massachusetts Medical Society)

PennState Sports Medicine Newsletter

Physical Activity Today

University of California at Berkeley Wellness Letter

The Right Moves (A newsletter of the Council of Physical Education for Children (COPEC))

Tufts University Diet & Nutrition Letter

Woman's Health Advocate Newsletter

### **Fallacy: Smokers need more vitamin C.**

**Fact:** The 1980 RDA for vitamin C was four times a normal person's need! This RDA was based on experiments that included large numbers of smokers. Addressing this issue Dr. Alfred E. Harper, Professor of Biochemistry and Nutrition Sciences at the University of Wisconsin stated "If anything, it would be much more appropriate to suggest that nonsmokers need less." (cited in Forsythe, 1990, p. 97).

### **Fallacy: Massive vitamin C overdose can prevent colds.**

**Fact:** Experiments using large numbers of volunteers, that either took a vitamin C megadose or a placebo, showed no difference in cold prevention. However, a daily dose of 250 milligrams (contained in 16 oz of orange juice) might have a mild effect on reducing the severity of the cold symptoms. No additional benefits were demonstrated by higher doses of vitamin C.

### **Fallacy: Massive vitamin C overdose can prolong survival time in terminally ill cancer patients.**

**Fact:** In clinical trials of more than 100 cancer patients at the Mayo Clinic no differences between the vitamin C and the placebo groups were observed for longevity, appetite, severity of pain, weight loss, or amount of nausea and vomiting.

### **Fallacy: Vitamin E supplements help decrease mammary dysplasia (benign fibrocystic disease of the breast) in women.**

**Fact:** Two independent studies conducted at the Sinai Hospital of Baltimore, and at the University of California in San Francisco showed no differences between the placebo and the vitamin E groups.

### **Fallacy: Overdosing of certain vitamins protects against "stress."**

**Fact:** While it is true that under certain physical exertion conditions the need for micronutrients increases, it seldom mounts above the RDA. If you are under so much stress that you may become vitamin deficient, you would be better off seeing your doctor rather than visiting your favorite health store.

### **Fallacy: Megadoses of pyridoxine (vitamin B6) help alleviate the premenstrual syndrome.**

**Fact:** While the supporting evidence for this view is equivocal and stems from small scale studies, there also are reports of adverse effects of pyridoxine overdose, such as damage to the nervous system.

### **Fallacy: Vitamin B12 shots can energize individuals who experience a general feeling of weakness.**

**Fact:** A B12 vitamin deficiency is rare among healthy adults and its takes several years before the side effects appear. Individuals suffering from a condition called pernicious anemia cannot produce a substance crucial in the absorption of vitamin B12 from food. Only these individuals may benefit from B12 ("liver") shots.

### **Fallacy: Potatoes are fattening.**

**Fact:** A seven-ounce plain potato baked in its skin has about 145 kcal. That is slightly less calories than contained in a cup of plain cooked spaghetti (155 kcal) and considerably less than a cup of cooked white rice (226 kcal). Potatoes, are high in complex carbo- hydrates, fiber, vitamin C, niacin and potassium. It contains no fat and is low on sodium. Seven ounces of French fries or McDonald's hashbrowns, on the other hand, contain 554 kcal and 529 kcal respectively, and unlike a plain potato are not considered to be high density foods.

### **Fallacy: Eating grapefruit will increase fat metabolism and decrease appetite.**

**Fact:** Advocates of the grapefruit or grapefruit concentrate in form of pills believe that it contains special enzymes that increase body fat metabolism. One half of a medium size grapefruit provides 56 kcal, almost 100% of the RDA for vitamin C, 15 g of carbohydrate, 1 g of protein, calcium, vitamin A and even some iron. Adding grapefruit to your diet, therefore, can be beneficial to you. There is, however, nothing in grapefruit, or for that matter in any other known food, that will increase fat metabolism.

### **Fallacy: To lose weight, one must give up eating sweets.**

**Fact:** An important part of every diet plan is its resemblance to the individual's life style. Therefore, the modification, rather than the complete change of one's eating habits seems a more realistic approach. As a matter of fact, M.I.T. researchers speculate that the increased release of serotonin by the brain, following the ingestion of sweets, may be related to the craving for sweets in some individuals. Whether this theory is true or not, controlled amounts of sweets might help some individuals satisfy the "craving" for serotonin and they still can

lose weight.

**Fallacy: Cottage cheese is an excellent source of calcium.**

**Fact:** The special curdling procedure used to prepare cottage cheese promotes a 25-50% loss of calcium present in the milk it was made from. Low fat yogurt and low fat milk retain all the calcium from the milk they were made from, and thus, are excellent sources of calcium.

**Fallacy: Electric muscle stimulators can firm you up and help you lose weight without you having to move a muscle.**

**Fact:** If it sounds too good to be true, you can bet it is! Electric stimulation of the buttocks, thighs, and abdomen for 35 minutes, as measured by investigators at Northeastern University in Boston, burned only 6 kcal. At this rate it would take five hundred and eighty three 35 minute sessions, or approximately 14 days and 4 hours of non-stop muscle stimulation to lose the equivalent of one pound of fat!

**A FINAL NOTE**

**While malnutrition is often associated with inadequate energy intake in developing countries, in wealthy, industrialized countries it is often a result of eating too much, or too little of some components of the diet. Excesses and deficiencies of certain foods, according to Gaman & Sherrington (1990), are associated with "diseases of affluence." Foods currently consumed by Americans provide most vitamins and minerals in adequate amounts. However, the excessive intake of fat and total amount of calories, for example, is linked to increased risk of coronary heart disease and cancer. The current situation may be greatly improved by an emphasis on a well balanced diet and adequate exercise. It is well documented, however, that certain groups of individuals like children, child bearing age women, pregnant women, post-menstrual women, strict vegetarians, alcoholics and others, might have special nutrition needs (e.g, fluoride, calcium, iron, vitamin B-complex). If in doubt, check with your doctor. Do not treat yourself!**