Chapter 17 – Nutrition

Overview

Nutrition relates to the food and water we must continuously consume to support life. The human body is a highly dynamic biological machine and requires a varied intake of numerous macro- and micronutrients to optimally support physiological processes. While many states in the U.S require specific licensure to professionally administer nutritional programs to clients or patients, fitness professionals from coast to coast still need a foundational understanding of human nutrition in order to help clients best achieve their health and fitness goals.

Chapter Highlights

Nutrition Scope of Practice

It is imperative for fitness professionals to review and understand the laws and regulations around nutrition in their respective state. Many states require specific licensure as a Registered Dietician (RD) before being able to prescribe nutritional plans to clients. The requirements to become an RD are earning an approved bachelor's degree, completing of a supervised practice program, passing a national examination, and then maintaining the credential through continuing education. However, clients will undoubtedly have questions about eating better, so a foundational knowledge in human nutrition is essential to better inform those conversations.

Daily Energy Needs

Daily energy (calorie) needs are determined by three processes: resting metabolic rate (RMR), the thermic effect of food (TEF), and energy expended during physical activity.

Everyone has a base amount of energy that their bodies require to simply support life throughout each day. This is known as their resting metabolic rate. RMR is the amount of energy that a person's body expends if they laid completely at rest all day with no exercise. In other words, it's the amount of energy required for necessary bodily functions such as breathing, blood circulation, and a working brain. This can account for around 70% of the daily energy requirements for a sedentary person. The more body mass a person has, the higher their RMR will be to support that additional mass. A simple way to loosely estimate RMR is multiple a person's weight by 10.

Food itself has a thermic effect on the body. This refers to the increase in energy usage that is required to digest food. Approximately 6-10% of daily energy expenditure comes simply from the act of mechanically breaking down food for use.

Physical activity is the last factor that impacts daily energy needs. Physical activity is highly variable. To estimate total energy expenditure for a day, a person's RMR is multiplied by a factor of 1.2 to 2.1 depending on how active the person was during the day. Very light activity would be a factor of 1.2, while a day of heavy activity would call for multiplying the RMR by 2.1.

Protein

Protein is the macronutrient primarily responsible for tissue building and repair. It is also used to synthesize hormones, enzymes, and other regulatory peptides. Protein is not meant to be a primary source of energy for the body, however, in times of negative energy balance, the deaminated carbon skeletons of amino acids can be

converted to glucose and ketones for use in energy production. One gram of protein yields 4 calories; however, the body has to work harder to get to that energy output than it does with carbs. And if protein is consumed in excess, it will be stored as fat just like the other macronutrients.

Proteins are made up of amino acids linked together by peptide bonds. There are 20 amino acids that the body uses for various functions, but only ten of them can be regularly produced within the body. These are called nonessential amino acids. There are eight amino acids that are considered essential; meaning the only way we can get them is by consuming them from food sources. Then, two amino acids are labeled as semiessential. This is because the body can endogenously make them, but not in quantities large enough to support growth.

Food sources of protein can be considered complete or incomplete. A complete protein is one that contains all essential amino acids in appropriate ratios. A food is considered an incomplete protein if it is lacking even just one essential amino acid. Meat and dairy are the best dietary sources for complete protein. However, vegetarians and vegans can get their entire essential amino acid requirement by consuming complementary proteins. These are food sources—such as grains, nuts, legumes, and some vegetables—that do not contain a complete amino acid profile but will provide all essential amino acids when eaten in combination. The most common example of this is rice and beans.

Daily protein requirements will vary for each person depending on their respective activity levels. For sedentary adults, the Recommended Dietary Allowance is 0.8 grams of protein per kilogram of body weight per day (g/kg/day). As activity increases, so will the need for protein to help repair soft tissues and support physiological processes. Strength athletes will need around 1.2 to 1.7 g/kg/day, while endurance athletes will be slightly lower at 1.2 to 1.4 g/kg/day.

Carbohydrates

Because both proteins and fats require additional biochemical reactions to break them down to substrates that can be used for ATP production, carbohydrates are the source of fuel that the body prefers and can use most efficiently. The carbs we eat come in many levels of complexity. The simplest carbohydrate is a monosaccharide; a single sugar unit. Glucose (blood sugar) and fructose (fruit sugar) are two of the most common monosaccharides. Disaccharides contain two sugar units and include sucrose (common table sugar) and lactose (milk sugar). When longer chains of sugars are linked together, they form starches and fiber, which are also known as polysaccharides.

Most forms of carbohydrates are digested down to glucose before entering the blood stream, which yields 4 calories per gram. The more complex the carbohydrate is, the slower it is digested, and the slower it will raise blood sugar. This effect is rated on the glycemic index (GI). Foods with a high GI (e.g. sugar, candy, white bread) will spike blood sugar levels and require more insulin production, while foods with a low GI (e.g., whole grains, legumes, fibrous fruits) are better for long-term energy and regulation of blood glucose levels. Dietary fiber then refers to the components of plant foods that we cannot digest; however, they are still essential to eat to support gut health and motility.

For the average active person, consuming 6-10 g/kg/day of carbohydrates is adequate, and should make up around 45-65% of total daily calories, preferably from nutrient-dense sources like whole grains and vegetables. The diet should also include between 25 and 38 grams of fiber. Consuming carbohydrates in adequate amounts will spare proteins for muscle building, keep glycogen stores full to maximize performance, and help more efficiently utilize stored body fat for energy as well by keeping Krebs cycle activity high so free fatty acids can be more easily converted to ATP.

Lipids

Lipids are the fats and oils in the diet. There are three basic types of lipid, but most of them in the body and in food are in the form of triglycerides. Triglycerides are three fatty acids connected by a glycerol backbone. Fats are the most concentrated source of energy, yielding approximately 9 calories per gram. They are also essential for cellular structure and function, hormone production, insulating the body, and the transport and absorption of many micronutrients including fat-soluble vitamins A, D, E, and K.

Dietary fats are classified as either saturated or unsaturated. Saturated fats are ones with hydrogens bonded to every carbon in the chain. Saturated fats are implicated as a risk factor for heart disease because they can raise bad LDL cholesterol levels, so they are recommended to be consumed in smaller quantities than unsaturated fats. Trans-fats, which are fats that have been artificially hydrogenated for the purpose of shelf stability, are just as bad—if not worse—than saturated fats and have been shown to not only raise LDL cholesterol, but actually work to lower good HDL cholesterol.

Unsaturated fats come in two variants, monounsaturated and polyunsaturated. Both help promote healthy blood lipid profiles and serve to help regulate cholesterol. Both should be regularly consumed in the diet to support optimal physiological function and health. It is recommended that approximately 20-35% of daily calories come from fat sources.

Hydration

Water is the one compound that is vital to all forms of life as we know it. Approximately 60% of the human body by weight is water. While the body can survive weeks without food (depending on body composition), we can only go a short matter of days without water before succumbing to thirst and dehydration. Proper hydration practices are essential to support healthy living, and even more important when it comes to exercise.

Dehydration can quickly lead to a number of negative effects on the body. It decreases blood volume, performance, blood pressure, sweating rate (cooling), cardiac output, and blood flow to the skin, and increases core temperature, water retention, heart rate, sodium retention, use of muscle glycogen, and perceived exertion.

At a minimum, sedentary individuals should consume an average of 3 liters of water per day. To stay properly hydrated for fitness purposes, it is recommended to consume 14-22 ounces of fluid 2 hours before exercises. During exercise, 6-12 ounces of water should be consumed for every 15-20 minutes of intense activity. If exercise lasts more than 60 minutes, it is recommended to use a sports drink to ensure that carbohydrate requirements stay met and that electrolytes are replenished. Then after exercise, it is recommended to consume 16-22 ounces of water for every pound of body weight lost due to sweating.

Key Terms

Nutrition—The process by which a living organism assimilates food and uses it for growth and repair of tissues.
calorie (lower case c)—The amount of heat energy required to raise the temperature of one gram of water by one degree Celsius.
Calorie (upper case C)—The common unit of expression of energy equal to 1000 calories; the amount of heat energy required to raise the temperature of one kilogram or liter of water by one degree Celsius.
Kilocalorie—The scientific unit of expression of energy equal to 1000 calories; the amount of heat energy required to raise the temperature of one kilogram or liter of water by one degree Celsius.
Protein—Amino acids linked by peptide bonds.

Carbohydrates—Neutral compounds of carbon, hydrogen, and oxygen (such as sugars, starches, and celluloses), which make up a large portion of animal foods.

Lipid—A group of compounds that includes triglycerides (fats and oils), phospholipids, and sterols.