Fitness Nutrition
Specialist Manual

A nutrition resource for general fitness
and athletic training

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&
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NFPT takes a unique physiological look at nutrition as it applies to fitness and athletics and the apparently healthy individual. This manual offers insight regarding energy provision from the time foods enter into the digestive process to when they are delivered to body cells and most importantly how it all relates to fitness and athletics. Never has the physiology of nutrition been taught to the fitness professional in a way that is more intriguing and comprehensive!

This manual content comprehensively addresses complicated body functions relating to physiological processes and “nutrient metabolism” as it is affected by all forms of exercise, and its impact on issues ranging from general health to advanced sports performance.

NOTE – Your scope of practice as a Sports Nutrition Specialist allows you to provide insight relating to the interrelationships between physiology and nutrition relative to fitness, exercise, and athletic performance among apparently healthy individuals. Dietitians are the appropriate health care professionals to be consulted for the planning and managing of a patient’s diet in hospitals and providing specialized dietary advice to other than healthy individuals. Moreover, a dietitian should be involved in providing nutrition advice if the client is not apparently healthy. Sports Nutrition Specialists cannot diagnose disease and advise on treatment of disease. Dietitians provide nutritional care relating to the effects of disease on nutrient metabolism using diet therapy, nutritional assessments, and clinical nutrition counseling.

Understand that your implementation of nutrition methodologies discussed in this manual are applied at your risk as any fitness nutrition recommendations may result in client injury or even death without proper screening and the required involvement of the appropriate health care professional.
Taking A Unique Approach To Making Dietary Recommendations

Teaching healthy dietary practices can be viewed from 2 totally separate perspectives. One perspective, generally that of the dietitian and most fitness professionals, is to educate from the outside. To provide for client distinction between nutritious wholesome foods and junk foods, identifying carbohydrate, protein, and fat sources, and offering consumer advice regarding food labeling. The other perspective is from the inside, or physiological perspective to include an education on what the body does with different foods once ingested, and foods’ positive & negative affects on physical health and well being. Knowledge gained from both perspectives is important. However, since education from the “outside” perspective is so widely practiced and made so readily available, it may be more interesting to focus on the not so common “inside” perspective in this study & reference manual.

Let’s begin our studies by discussing the body’s internal nutrient provision & utilization systems. The following will reflect a variety of little known facts and functions that occur inside the body relative to educating clients in the area of enhancing positive lifelong dietary habits, as well as ways to prevent the negative effects of poor eating habits.

With these facts established, it seems logical that we next look at the purposes these nutrients serve once present in the bloodstream, the positive and negative effects of high and low levels of each, and lastly how to enhance the positives while minimizing the negatives through dietary control.
3,500 – The Simple Math

Why should the number 3,500 always stand out in your mind as a nutrition specialist? This number has everything to do with the prescription of an overall fitness program as it centers around the total caloric intake.

It has long been known that 3,500 calories equate to a pound of bodyweight in the metabolically average apparently healthy individual with select exceptions. In this particular aspect, fitness can be reduced to a mathematical equation. In a perfect world, you would first prefer to have the diagnostic capability to determine RMR (Resting Metabolic Rate). The term RMR is somewhat similar to the term BMR. The RMR test basically determines how many calories an individual expends while sleeping. Each individual has a unique RMR. Generally speaking, those who have difficulty in losing weight will have a low RMR and those finding it difficult to gain weight will have a high RMR. The diagnostic determination of RMR is by far more accurate than the vague determination of BMR most of us will likely be using in determining resting caloric consumption. Prolonged, extremely low calorie dieting will slow the metabolism even more and would be reflected in a follow-up RMR sometime after a restricted caloric intake had been maintained. For this reason, especially among those with already low RMRs, it is important to keep caloric consumption at or above RMR needs otherwise these already low RMR dieters may be positioning themselves for an even greater fat accumulation due to an even slower metabolism. Conversely, it is just as important to maintain RMR minimum intake among those with already high RMRs in order to prevent an undesirable starvation loss of body (muscle) tissue.

Individuals with low RMRs typically expend fewer calories during both daily activity and the performance of exercise than do those with high RMRs who are performing the same work. When considering total daily activity expenditures, keep this in mind. With this issue addressed we can get on with the application of the magic number 3,500.

Diet & 3,500...

The least attractive method used for fat loss is unfortunately the most commonly used...dieting!

First of all, when one diets, there is always the opportunity for the body to cannibalize muscles and not draw from its fat reserves. This is unavoidable and can only be offset in degrees through the performance of resistance exercise. Even during the most moderate dieting the body views fat reserves as being more valuable than lean muscle as a starvation fuel source to horde and will use sedentary muscles for energy instead. Through regular resistance exercise during dieting the body must continually adapt by the preserving and even building of otherwise useless muscle tissue in an effort to keep up with your imposed strength demands. This forces a greater degree of fat loss on a low calorie diet and the preservation of metabolically active muscle tissue which keeps the metabolic rate high.

Where do you draw the line when dieting? This is where the magic number 3,500 comes in. It is generally accepted that the optimum fat loss rate is achieved by consuming 500 calories/day below an individual’s weight maintenance intake need (RMR + daily activity + exercise expenditure). This is effectively measured in the tables provided elsewhere in this manual. At this 500 calories/day decrease, one should lose bodyweight at a rate of 1 pound per week (7x500=3,500). A diet any lower may result in unacceptable lean tissue loss. Conversely, those wishing to gain weight should also use the
number 3,500 to regulate their weight gain. When gaining weight, using resistance training in the process to optimize the lean weight increase and minimize the fat increase, the participant needs to keep additional calories at approximately 500/day over their weight maintenance intake (RMR + daily activity + exercise expenditure). Once again, this is effectively measured in the tables provided elsewhere in this manual. Generally, these additional 3,500 calories (500 calories/day increase) will result in weight gain at a rate of 1 pound per week.

Both fat loss as well as weight gain diets that are too extreme end up being counter-productive resulting in either too much muscle loss during weight loss dieting, or too much fat increase during weight gain dieting. Never, under any circumstances, prescribe a diet that is less than is required for RMR needs (approx. 11 x LBW discussed elsewhere in this manual).

**Exercise & 3,500...**

The healthiest, however most difficult, way to lose fat is to exercise. If one could perform activity with a caloric expenditure of 500/day, he/she will lose weight at a rate of 1 pound per week. With this in mind, where weight maintenance is concerned, an increased expenditure of 500 calories/day through exercise amounts to the same as reducing calories at a rate of 500/day. Conversely, a reduction of activity expenditure in the amount of 500 calories/day amounts to the same as a 500 calorie/day increase in calories. Once again, this is the ideal weight loss rate. Keep in mind when exercising for fat loss though, that intense aerobic activity causes lean tissue loss, and also that resistance exercise needs to be performed during fat loss dieting to minimize the lean weight loss while dieting.

For the weight gain fitness program participant, it is not recommended that he/she perform a significant amount of aerobic activity opting of course to perform heavy resistance training to optimize lean weight increase. Unlike the fat loss participant, the best method of weight gain is to increase calories, taking care to perform resistance exercise at moderate to high intensity to insure against undesirable fat accumulation.

**Diet & Exercise...**

Combining proper caloric intake with the right exercise program is the preferred method of achieving any weight maintenance goal, fat loss or weight gain. Understand that if the participant is exercising and dieting each of these two variables need to be considered. For example, if a fat loss fitness program participant is expending 300 calories/day during exercise, the daily caloric intake need only be reduced by 200 calories. If the weight gain participant is expending 300 calories/day during exercise, the diet needs to be increased by 800 calories offsetting this expenditure to arrive at the desirable 500 calorie/day increase.
Metabolism of Nutrients

Carbohydrate Metabolism

Carbohydrates are ingested; enter into the stomach, and then into the small intestine, where almost all digestion occurs. The principle enzyme that breaks down carbohydrates in the small intestine is amylase. These enzymes then break down carbohydrates into simple sugars such as fructose, galactose, glucose, and smaller chains of glucose molecules (glucose polymers).

These simple sugars are then absorbed through the lining of the small intestine and transported to the liver through the portal vein where the liver then converts all these simple sugars into the common sugar glucose. Glucose is the only usable form of simple sugar in the body.
The liver, the most active organ in the body, performs some 64 vital functions. The liver releases this new glucose into the bloodstream to raise blood sugar levels to where they are supposed to be. If the supply of this newly ingested glucose is too high, it raises the blood sugar level. The excess glucose must be eliminated from the bloodstream. The pancreas houses the hormone insulin. When the blood sugar reaches increasing levels, insulin is released to transport and/or make available the excess glucose to body tissues. The muscle tissue is then the first stop for “insulin-carried” glucose, only after exercise when muscle energy stores are low. Insulin actually opens up receptor sites on muscles allowing for the uptake of glucose to replenish depleted muscle energy stores. Once glucose is absorbed into the cell it is used for energy, the unused portion of this new glucose is then converted and stored in the muscle as glycogen. Glycogen is then saved in the muscle cells for anaerobic (heavy) activities. It is important to note that muscle tissues can only take up glucose at a gradual rate. If too much insulin-carried glucose is available at one time in the bloodstream, insulin’s next stop for the storage of this abundant glucose is the liver.

Not unlike muscles, the liver can only take up glucose at a gradual rate. The liver has the potential to store between 300 and 400 calories of glycogen. This liver glycogen, in contrast to muscle glycogen, is primarily used for brain function as well as for aerobic activities. When the liver stores are full, and there is still a considerable amount of excess insulin-carried glucose in the bloodstream, it will be taken off and stored as fat in adipose tissue. Unlike muscle & liver, fat (adipose) cells store blood glucose quite rapidly.

It is important to note that if the carbohydrates ingested are already simple sugars, or are low in soluble dietary fiber, they will be taken up into the blood too quickly. The pancreas then reacts quickly resulting in an “over-release” of insulin. Since the muscle tissues and liver take up blood-glucose very slowly, the surplus of insulin-carried blood glucose will bypass the two, and be rapidly stored in fat cells. Also, since the hormone insulin overreacts in this situation, and it’s function is to eliminate sugar from the blood, within 20 to 30 minutes, blood sugar levels may fall below resting levels (hypoglycemia). This reduces the glucose supply to the central nervous system having a noticeable effect on higher brain function, making you feel sluggish, tired, and run down.

The liver is then responsible for correcting this low blood sugar problem with the help of another hormone called glucagon, which is also released from the pancreas. Glucagon is released in response to low blood sugar levels. The glucagon then triggers the liver to release stored glycogen as glucose to replenish blood-sugar levels. This intermittent release of stored glycogen from the Liver to regulate bloodsugar primarily for brain function is known as glycogenolysis.

If glucagon reaches the liver and for some reason, such as extreme dieting, or overexertion, the liver cannot provide glucose for the blood, a sequence of events occur resulting in the eventual breakdown of blood proteins, and the undesirable cannibalism of organ and muscle tissue for the needed glucose energy. This process of tissue breakdown for energy is known as gluconeogenesis.

**Protein Metabolism**

The body has the life sustaining ability to transform ingested proteins into living body tissues through a series of metabolic processes.
When a protein is ingested it moves from the stomach into the small intestine, where almost all digestion occurs. The enzyme pepsin acts to break down proteins into smaller proteins (peptides) and individual amino acids. Complete proteins need to be ingested every 3 to 4 hours to ensure the availability of all possible combinations of amino acids for cellular uptake.

Since the body cannot store individual amino acids, they are collected and exchanged in the liver, the blood, and the interstitial spaces (space surrounding individual muscle fibers), and cannot be used for cellular protein synthesis until all of the right combinations are present at once. The amino acids that are present are useless for protein synthesis until they are combined with the required missing amino acids. If the missing amino acids are not provided within 3 to 4 hours, the existing amino acids are deaminated and are no longer useful for protein synthesis.

The liver uses amino acids to build and store cannibalistic enzymes as well, for their release during times of physical stress. The liver builds blood proteins using amino acids. When the diet is insufficient in protein sparing carbohydrates, amino acids are deaminated by liver enzymes and used to produce glucose energy with a toxic by-product of ammonia. This by-product is further broken down by the liver into urea toxins and excreted in the urine.

The above amino acid deamination occurs via a process called gluconeogenesis, and usually occurs during strict dieting, overexertion, and/or while on a very high protein intake. This process is obviously undesirable because amino acids should be spared to rebuild tissues and make structural repairs. The most effective way of sparing amino acids for this purpose is to ensure the ingestion of sufficient amounts of carbohydrates to provide for imposed energy needs. It is also important to note that too much protein intake may place undue stress on the liver and kidney in the case of a pre-existing condition. In order to minimize this stress while on a high protein intake, ingest large quantities of fluids.

**Fat Metabolism**

Ingested fats travel through the stomach and into the small intestine. The lipolytic enzymes bile and lipase act upon them, which is an emulsifier. Once broken down by these enzymes into phospholipids, triglycerides, and cholesterol, they are packaged back into chylomicrons and bypass the liver, entering directly into the bloodstream through the lymphatic system. These chylomicrons are taken up by adipose tissue or eventually make it to the liver where they are broken back down into phospholipids, triglycerides, and LDL and VLDL cholesterol. It is interesting to note that the VLDLs and LDLs that are ingested are exactly the same as that cholesterol the liver makes.

The phospholipids are released into the blood for transport to cells for structural membrane formation. Some of the triglycerides are broken down into fatty acids and glycerol. The fatty acids, which are the body’s abundant source of energy during both low-level and steady state aerobic activity, are released into the blood. Glycerol is converted to glucose and either stored as glycogen, or released into the blood as well. Remaining triglycerides are either stored in the liver, or released into the blood for storage in fat tissue, and possible collection in the interstitial spaces (compartments surrounding muscle fibers) for adaptive purposes, which will be discussed elsewhere.

The LDL and VLDL cholesterol is released into the blood and are responsible for platelet formation in cardiovascular tissue contributing to cardiovascular diseases.