RESISTANCE TRAINING
SPECIALIST MANUAL

an essential guide for weight and
resistance training for sports and fitness

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NFPT
National Federation of
PROFESSIONAL TRAINERS

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Resistance Training Specialist Manual

An essential guide for weight and resistance training for sports and fitness

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NFPT - WEIGHT TRAINING SPECIALIST

Recommended Reading – NFPT Personal Trainer Manual, as well as the Sports Nutrition Manual & Endurance Training Manual for the best possible holistic education experience.

Preface & Introduction

Candidates MUST Read Below

Welcome to one of the most unique and valuable approaches to learning advanced education in the area of resistance training as it relates to health, fitness, and sports. Be prepared for an "inside out" approach to the study of resistance training. Unlike most study & reference manuals teaching to this subject, this manual is based around the exact same independent research that has earned the National Federation of Professional Trainers (NFPT) its esteemed position as an industry leader having credentialed thousands of certified fitness professionals. For the purpose of comprehension NFPT research has been translated and presented such that complicated relative body function and scientific terminology as they relate to resistance training topics are better understood. This policy is the hallmark and tradition of the National Federation of Professional Trainers.

Weight training education is where NFPT excels. It is undisputed that NFPT pioneered weight training education and research long before it was universally accepted as a means to managing bodyweight and maintain a state of physical fitness among general fitness enthusiasts. Resistance training education emerged from the observations made by scientists concerning the results of resistance exercise on the competitive bodybuilder. In the middle 80s, there weren't any resistance based certification programs until 1988 when NFPT, based on studies and research involving bodybuilders, made it's début in the weight training education and the personal trainer certification industry.

Any number of books today can effectively educate on the rudimentary approach to resistance training but none offer the insight provided by the National Federation of Professional Trainers. This manual is beyond the scope of those resources and is meant to complement them in an effort to produce the best and most advanced resistance training professional possible. The candidate assessment for the credential of NFPT "Advanced Weight Training Specialist," will require you to have mastered the understanding and possess experience in the fundamental application of weight training and a measurable degree of relative Knowledge, Skills and Abilities (KSAs) on this topic. The assessment of your comprehension of related education for this credential may call upon additional existing KSAs in some areas of resistance exercise on the part of the candidate possibly not presented in this manual.

The NFPT "Advanced Weight Training Specialist" assessment is pass/fail with a cut score of 70%. This "Resistance Training Specialist" Study & Reference manual teaches no less than 75% of the required KSAs necessary for successful "Advanced Weight Training Specialist" candidate assessment results.

All of these individual chapters focus around diverse scenarios teaching to the direct holistic interaction that exists between the relative human anatomy & biology, and the application of force and resistance against muscular contraction. Education on how the body functions and adapts to applied resistance is paramount and is the trademark of the National Federation of Professional Trainers. The interaction and responses on the part of multiple body systems relating to the application of varied amounts of resistance is the exceedingly overlooked element of resistance training programs. You will find the educational

approach unique and enlightening as NFPT methodologies are discussed and the sound scientific reasoning behind the research is presented. Learn how NFPT research findings impact issues ranging from weight maintenance to extremely advanced resistance-based sports performance.

General Health and Resistance Exercise Considerations

General Resistance Exercise Advice

Who Should Establish a Goal of General Fitness?

If you are looking for a self-improvement exercise program, and you are a non-athlete, chances are you fall into one of three categories. First, you may be over-weight. If this is the case, fat loss may be your goal of choice. If you are under-weight, weight gain may be your goal of choice. Finally, if you are not grossly over, or under weight, and as stated earlier, you are a non-athlete then general fitness will quite likely be your goal of choice.

What is General Fitness?

All forms of exercise have value. The question is, finding the exercise that will give you the results you want and need. General fitness is a compromise, of sorts, between aerobic activity and resistance activity. Ideally, the optimum general fitness exercise program will include the best of both these worlds.

The proper resistance exercise routine can cause not only an increase in muscle tissue, but a cardio affect as well. This simply means that while you are conditioning the muscles by weight training, you can condition the cardiorespiratory systems by shortening the rest periods between the exercises you perform. While this is true, it should also be considered that during resistance exercise, regardless of the shorter rest periods, there is little in the way of improved "fatty acid oxidation". This simply means that the muscle's uptake of fat and oxygen during the performance of this fast paced resistance activity is not significantly enhanced.

The term "general fitness" implies low-to-moderate intensity of effort, which is correct. To increase the intensity of effort in general fitness training, is to change your goal altogether. Whenever intensity of effort is great, there is a degree of adaptation undergone by the body. This type of adaptation is desirable to the "incremental" athlete, or to those interested in conditioning themselves for a higher level of fitness or some sort of sport (there is an entire section devoted to sports conditioning later in this manual).

Generally speaking, for our purposes here, general fitness can best be achieved through a combination of fast-paced resistance exercise, and the performance of low intensity, long duration, steady state aerobic activity (70% of maximum heart rate maintained for about 20-30 minutes per session, with sessions performed no more often than 3-4 times per week). If one were forced to choose between fast-paced resistance exercise and low-level aerobics for general fitness, fast paced resistance exercise should be the activity of choice.

Setting up a Resistance Program for General Fitness

When you choose to establish a general fitness routine based around resistance exercise, incorporate the following concepts.

Use a 2-day split routine. This is to say you should do half your muscle groups on day #1, then the other half of your muscle groups on day #2, and then rest or perform aerobics on day #3. In layman terms, the major muscle groups to be considered in creating these routines are the chest, back, triceps, biceps, shoulders, trapezius, hamstrings, glutes and quadriceps (perform exercises for abdominals, forearms, and calves randomly as desired).

Stay in the area of 12-15 repetitions per set, to unassisted failure. This will provide for some lean weight increase, muscle energy increase, and with reduced between set recovery, some cardio as well. Your performing in the 12-15 repetition range represents the necessary compromise between heavy and light training, and will enable you to more quickly reach your general fitness goals.

If the cardio affect is desirable, remember to take shorter rest periods between sets. Your recovery heart rate should be somewhere around 115 BPM. This is to say that your heart rate, after a set, needs to come down to approximately 115 BPM before you continue with your next set. Keep in mind that the faster you train the more repetitions you will drop in each following set. This is especially true in the beginner. With time, you will reach a point where you are losing fewer and fewer repetitions. Wastes accumulate in the muscles during sets in this repetition range, while at the same time blood

presses against the muscles (pump). For this reason, wastes can't get out, and causes the muscle to fail sooner in the next set. You have a decision to make. If muscle size is more important than cardio slow down. If cardio is more important than muscle size then speed up. Three of the ways the muscle will adapt to this type of training are by #1) gaining some strength, #2) learning to remove these wastes more efficiently, and #3) by learning to store more energy. These are all desired affects for general fitness.

The Pause Factor

Pausing slightly between repetitions will allow for prolonged performance. These relaxation pauses give the working muscles time to eliminate more waste and to get more nutrients from the blood during the set. This will allow for the performance of more muscle damaging repetitions and place more emphasis on muscle growth than on muscle energy increase and cardio. A pause should NOT be taken when the joint is fully extended. This is dangerous to hard tissue such as ligaments and tendons, and could lead to chronic or acute injury. In most cases it is advised to perform all resistance exercise with continuous tension to avoid unnecessary injury.

Certainly the above is not intended to represent or include every aspect of a good balanced fitness program, only to show there are many different ways to implement resistance training as a means to a general fitness end. Keep in mind that resistance training is what this entire manual is all about and does not place emphasis on the "5 components of fitness". This type of education is available in any number of NFPT educational manuals.

**NOTE* - Remember to perform prolonged, low-level aerobic activity, as stated above on your day off if steady-state aerobic conditioning is desirable, as well as making stretching, warm up, and cool down considerations. Never perform intense aerobics before your resistance exercise routine. You will lose lean muscle tissue (discussed elsewhere in this manual).

Strength Training & Those at Risk

Now that resistance training has successfully etched out its place in fitness, strength training has become a very popular and researched practice. Strength training may mean different things to different people however. You see, strength training to a healthy 21 year old man will likely mean 5x5 275 lb. bench presses at 100% intensity, while to a 60 year old woman who is at risk it will likely mean 3x12-15 on the bench press at only 70% intensity.

In the professional community, strength training for controlled groups is not nearly as strenuous as strength training applied to the recreational and competitive athlete. Is this a bad thing? No. In fact, it's a very good thing. Individuals in controlled groups are working within a whole different set of parameters: Parameters that redefine their strength training goals altogether. For the sake of discussion here, those in controlled groups are individuals who are at risk for one or more reasons (refer to NFPT Guidelines for Risk Factor Identification). These are participants whose goals are to achieve and maintain a level of fitness that will allow them to minimize their health risks, function well in their work, maintain healthy body composition, and have the energy to participate in occasional recreational activities comfortably. Of course, to achieve this there is a need for the regular performance of aerobic activity in addition to strength training but our focus here is on strength training. It is equally important that multi-directional and balancing activities are per-

formed for general fitness and should complement the strength training program. This activity can improve mobility and reduce injury risk in controlled groups.

The obvious and most researched benefits of strength training to those in special populations are improved bone strength, improved body composition, lowered blood pressure, mental alertness, and a reduction of cardiovascular accidents.

It is best to keep poundages down and repetition ranges somewhat higher among those at risk to minimize injury while watching for contraindications (listed elsewhere in this manual). Also, with slightly higher repetitions there is a greater amount of blood perfused into collateral circulation (capillaries in intramuscular areas). This feeds and builds involved muscle tissue more efficiently. It has been shown that through resistance training in special populations, capillary beds in and around muscles actually branch out in the intramuscular areas revitalizing muscles that would otherwise be atrophying away to uselessness.

The true application of strength training for this 'special population' is different than the application of strength training for the recreational athlete. The athletic application of strength training is for enhanced muscle size and strength, improved athletic performance and/or the resulting improved appearance of the musculature. Strictly performing strength training in the long-term absence of multi-directional activity, regular aerobic and high repetition training will result in muscle imbalances, instability, and cardiorespiratory inefficiency. This applies to ALL exercise participants. It is good that 'apparently healthy' people seeking improved general fitness subscribe to NFPT outlined strength training methodologies as these recommendations are somewhat universal in their application. In other words, what's good for one is generally good for all. Training in low heavy repetition ranges at 100% intensity will result in lean weight gain in ALL participants, even among those at risk (applied only with physician's involvement). Any and all resistance exercise that is reasonably tolerated by special populations is considered strength training and is beneficial for maintained health and vitality.

Importance of Water

An estimated 60% of total body weight is water. Water helps to maintain body temperature and allows for over 50% of all internal chemical reactions to occur. It is also responsible for the movement of nutrients, digestion, absorption, circulation, and the excretion of wastes.

Water also is a vital component in synovial fluid (which is a joint lubricant) and cerebrospinal fluid in the nervous system. Water is in part responsible for the transmission of light and sound in the eyes and ears.

The body's average daily loss of fluids through excretion, respiration, chemical reactions, and perspiration varies from about 1 to 3 quarts. A high protein intake calls for an even greater amount of fluid intake.

At 2% dehydration the body's work capacity decreases by 12 to 15%. Body temperature and heart rate increase during periods of dehydration. The body's prevention mechanism is osmorecepter transmission to the brain, stimulating

a sensation of thirst prior to the occurrence of dehydration.

The most common threat of dehydration occurs with vomiting and diarrhea during illness, calling for not only the replenishment of fluids but also electrolytes and minerals.

In any case, when the body is deprived of fluids, it will pull water from any or all reserves in an effort to maintain critical blood volume and a safe body temperature. A prolonged low fluid intake, high sodium ingestion, or excessive prolonged use of diuretics (such as caffeine, alcohol, and others) can trigger a variety of hormonal responses resulting in the survival storage of surplus fluids. By increasing fluid intake, this survival storage response will be effectively reversed and a loss of excess water weight will occur.

Fluid imbalances contribute to a host of metabolic disorders. You can easily reduce all of these potential health threats by simply getting into the habit of drinking more water, at least 8 to 10 glasses daily.

Water can be absorbed from the small intestine at a maximum rate of 8 to 10 ounces every 20 minutes, and should be ingested during and after exercise (especially in hot, humid climates).

When preparing for exercise, anticipating a profuse sweat, simply weigh in prior to and after, then ingest 16 ounces of water per pound of weight lost, at the above prescribed rate (8 to 10 Ozs. every 20 minutes).

Never take in large amounts of sodium during exercise. The temporary hypertonic concentration of sodium in the blood will result in an osmotic shift of fluids out of the working muscles. This causes severe cramping and increased susceptibility to heat injuries (such as heat stroke and heat exhaustion.)

However, if activity is very intense and/or lasts longer than about 60 minutes a sports drink can be used that is 6 to 8% sugar solution (over 10% may interfere with fluid absorption), and a sodium concentration of about 100 mgs/8 Ozs. of fluid. Sweat rates vary and may increase the need for fluid and electrolyte replacement. Also, it is advised to drink between 16 and 24 Ozs. of fluids within 30 minutes after any event completion.

Also, stay away from any amino acid supplement that is produced by a process called "hydrolysis." Some amino acids are compromised and rendered useless through hydrolysis. Moreover, these supplements could include toxic by-products formed during processing.

What Makes Us Thirsty?

Sodium, being the electrolyte responsible for fluid retention, holds the key to why we thirst. Throughout the day, active or not, there is a gradual reduction in blood fluids from chemical reactions. Of course, this occurs much more rapidly during exercise than at rest, but never the less it occurs constantly.

When fluids are lost and sodium remains, there is a steady increase in the concentrations of sodium in the blood. When the concentration reaches a certain level osmoreceptors trigger the thirst centers

in the brain to create the sensation of thirst. Upon the ingestion of additional fluids, the sodium concentration is diluted down to acceptable levels shutting down the thirst center in the brain.

The Electrolytes Sodium & Potassium

In better understanding these electrolytes and their significance relating to the subject matter, it is accurate to say that Potassium is the electrolyte that pulls fluids into the muscles while Sodium pulls water out of the muscles. When sodium is more concentrated outside the muscle than the potassium is inside the muscle water shifts out of the muscle (undesirable). This will cause cramping and heat injuries. When sodium is less concentrated outside the muscle than the potassium is inside the muscle water shifts into the muscle (desirable). An ongoing chemical reaction called the "sodium/potassium pump" works continuously in an effort to maintain a balance of these electrolytes. In fact, 2/3 of all the energy being used at rest is needed by this "pump" to maintain this crucial water balancing act. Moreover, be aware that water is also brought into the muscles along with carbohydrates (Insulin-carried glucose), at a ratio of 3 to 1. This is a contributing factor to muscle size increase during carbohydrate loading.

There is no established dietary requirement for sodium but it is generally observed that the usual intake far exceeds the need. The average American ingests 6-18 grams of sodium chloride each day. The National Research Council recommends a daily sodium chloride intake of 1 gram per kilogram of water consumed. An excess of sodium ingestion may cause an increased amount of potassium to be lost in the urine. A prolonged abnormally high amount of sodium in the body will result in fluid retention accompanied by dizziness and swelling of areas such as the legs and face. An intake of 14 to 28 grams of salt daily is considered excessive. It should be known that diets consisting of excessive amounts of salt contribute to the increasing incidents of high blood pressure. The simplest way to reduce sodium intake is to eliminate the use of table salt.

It is generally correct that blood concentrations of sodium, found in salt, is directly related to the regulation of safe body fluid levels as a part of the process previously discussed. Another benefit to the presence of sodium is the re-absorption of water (otherwise excreted) in the kidneys.

While there are various neurotransmitter and hormonal actions that play vital roles in this delicate balancing act, water intake and sodium level manipulation are the only means by which to consciously attempt to control fluid levels (without physician assistance and/or the use of prescription dose medication).

At first glance, the ingestion of large amounts of sodium would appear to be a must for any dehydrated condition, regardless of its cause. This is simply not the case, especially in regard to exercise induced fluid loss. During exercise, especially in a warm environment, water loss is attributed to perspiration, increased water dissipation due to heat generated during accelerated chemical reactions, increased respiration, and lastly, water losses from inside working muscles due to the friction caused by increased contractile component movement. Significant amounts of sodium (3.0 to 5.0 grams) ingested less than 1 hour prior to the performance of intense and/or prolonged activity in hot and humid climates, should be avoided. The basis for this recommendation lies in the complete understanding of the above sodium concentration con-

cept as touched upon below.

If the vascular system is maintaining a certain concentration of sodium throughout, and a great amount of sodium is ingested in a single dose just prior to, or during exercise, the vascular system will immediately direct fluid to the localized area where the sodium is now too concentrated (mostly in the gut) in order to "dilute" this sodium down to the normal concentration levels. This is accomplished by drawing upon "reserve fluids", in most instances from the intramuscular areas. This temporarily pulls desperately needed water out of the working muscles, and in extreme cases, the heart, leading to severe dehydration, muscle cramping, and in the case of the heart, this short-term fluid loss could result in cardiac failure. For these reasons it is obvious that "salt tablet" use, still practiced by some coaching staffs on various levels of athletics, should be discontinued.

Cardiac Response to Eating and Exercise

Do not eat within 2-3 hours prior to prolonged and/or intense physical activity. There is a physiological change that takes place relative to the cardiovascular system upon ingestion of foods. This change during digestion acts to redirect blood flow from the muscles to digestion.

Since the body's total blood volume desirably remains the same, the movement of excess blood to any one part of the body requires an enlargement (vasodilatation) of the vessels in that specific region, and a reduction (vasoconstriction) in the size of the vessels in all other regions. When you eat, there is a greater need for blood in and around digestion for the purpose of carrying nutrients to the main vascular tree. When vessels dilate around digestion, they constrict in muscular areas. If you perform prolonged and/or intense exercise during digestion, the central nervous system will constrict vessels around digestion and dilate vessels in the working muscles. This nervous input and redirection of blood flow slows digestive processes and the motility of the digesting food in the gut. As a result you may experience not only cramping but also nausea, dizziness, and a general feeling of fatigue.

Eating Around Resistance Exercise Sessions

Pre-Workout Meal

The pre-workout meal should be ingested hours prior to the performance of resistance exercise. How many hours? As many as 2-3. This is about the same time period as recommended before aerobic activity but for a different reason. Consider this, in intense resistance exercise, little if any energy is being provided to the muscles via the bloodstream. The shorter and more intense, the less extramuscular energy required. This generally means that energy used during most resistance exercise comes predominately from sources within the working muscles. This being the case, there is less need to insure that liver glycogen stores are full, or even that circulating blood-sugar is optimal (since intense exercise causes an "Insulin-like reaction" in apparently healthy individuals resulting in the conversion of stored glycogen to blood-glucose energy). In preparing for a resistance training session as described above, it would be appropriate to eat a pre-workout meal as much as 2-3 hours prior that is high in protein and complex carbohydrates. This timing will insure that the early stages of digestion (in the stomach and small intes-