

# Weight (Resistance) Training Concepts

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## WHY Weight Train?

Simply put, if you are just doing aerobic exercise you are only getting about half the benefits of exercise. Aerobic exercise does a wonderful job improving and maintaining cardiovascular health. It would be enough if all we were consisted of was a heart, lungs, and legs. However, the rest of your muscles must be challenged; it's the old maxim, use it or lose it.

People typically lose ½ to 1% of their muscle mass each year after age 35, a wasting process known as sarcopenia. Sarcopenia slowly steals everyday functionality and eventually leads to crippling frailty. It also contributes to increasing body fat, lower metabolism, osteoporosis, injuries and even heart disease.

Weight training, properly known as Resistance Training (RT), is the only means to delay and resist this age and lifestyle related decline. Over 6 months, RT induced youth-like mitochondria gene expression in elderly subjects, in effect “reversing” aging of skeletal muscle (Melov 2007).

In 2007, for the first time the American College of Sports Medicine and the American Heart Association jointly recommend strength and endurance training for healthy adults. Studies now show that strength training is an independent factor in the reduction of heart disease and the improvement of longevity. As little as two sessions a week consisting of 8-12 exercises is sufficient to meet this recommendation.

## What You Will Learn Here

The original title of this paper was weight lifting 101. It was intended to be a SHORT all purpose beginners guide, but eight pages into the draft and far from complete, I realized adequate coverage would end up more like a book. The problem is that proper weight training program design is very goal, stage, age and gender specific. Instead of re-writing a book, I'll provide some good book references at the end, with links on my website.



Barring some dedicated self-study on your part, hire a qualified

personal trainer to set up a program. My personal observations are that most people are clueless when it comes to RT. Unless less results, more injuries and wasted time is your goal, conduct a serious study of RT design OR hire someone to teach you.

The objective of this paper is to provide someone already familiar with the basics of RT some additional insights and tips. I try to put a slightly different spin on things to emphasize key points. Even if you are a total novice, it will illuminate some key concepts that will serve as a useful adjunct to your studies.

## Key Concepts

All RT involves the combination of seven variables; frequency, intensity (resistance), speed, mode, rest interval, repetitions and sets. Your goals determine what specific combinations will lead to the quickest results. Consistent with goals, stage, age and gender, an individual doing one set, 12-15 reps, 65% of 1RM is CORRECT as well as another individual doing six sets, 1-8 reps, 90-100% of 1RM.

### RT Terminology

**Frequency** – how many sessions of RT you perform per week or given number of days

**Mode** - what types of resistance, free weight, cables, machines, eccentric or concentric movements

**Intensity** - how much resistance you employ per movement, often expressed as a percent of One Repetition Max (1RM). 1RM is the maximum amount of resistance you can lift one time. The maximum amount you can lift 10 times roughly equates to 80% of 1RM.

**Speed** - how fast you move the resistance

**Sets** - how many times within a session you perform a specific exercise

**Repetitions** - how many times per set you move the resistance

**Rest Interval** – time between sets

### Common RT goals include:

General functional fitness to maintain muscle mass, health, strength and balance

Remedial functional fitness to restore muscle mass, health, strength and balance for the unfit or elderly

Supporting weight loss and increasing muscle tone.

Heightened muscle strength to better perform sport specific movements

Muscle growth (hypertrophy) for both increased strength and cosmetic appeal

Maximum strength for specific lifts, as in competitive Olympic weightlifting

Goals are not mutually exclusive, but to maximize results for any one goal requires a specific combination of the seven RT variables. In general, out of shape people need to begin with higher reps 10-15, short 30s rests, fewer sets and lower resistance in the <70% 1RM range. To develop pure strength requires low reps 1-8, multiple sets, long 2m-5m rest and near maximum resistance up to 100% of 1 RM. To maximize muscle growth or hypertrophy, utilize moderate reps 8-12, multiple sets, short rests and moderate to high resistance 80% 1RM.

Failure is an objective in RT. The closer you get to the point of failure where you cannot safely and properly move the resistance again, the better you have stimulated your muscle. Pushing to near failure or failure makes micro

tears in muscle fibers. This fiber tear down causes your body to make a positive adaptation, building more and stronger muscle tissue. The increases in muscle strength and growth occur between workouts, making the proper rest intervals essential to RT.

Of all the RT exercise variables, higher intensity elicits the most improvement. In short, if you have to choose between more frequency, sets, reps or intensity; intensity wins out. Higher exercise intensity is an independent factor in improving overall mortality (Tanasescu 2002). Higher intensity can lead to higher injuries so a safe rate of progression is required, particularly for the out of shape or older population.



A diminishing return occurs over time with RT. The more you do a specific exercise, the less effective that exercise becomes in eliciting useful change. This is known as Specific Adaptation to Imposed Demand or the SAID principle. When you reach a plateau where you can no longer add stimulus, more resistance, reps etc, your body will cease to further adapt to that specific exercise. Continuing that exercise will preserve the mass and strength you have obtained, but further development will cease.

Periodization is the proven strategy to overcome SAID (Rhea 2002). It is also a means to reach peak performance before a competitive athletic event. Specific exercise routines are broken into mini, meso and macro cycles of days weeks and months. Resistance or volume is progressively added to exercises reaching a peak at the end of a predefined cycle. These progressive cycles are followed by a rest cycle or change in exercise specifics

for a new cycle. An even more dynamic variation to regular linear periodization is called “Daily Undulating Periodization (DUP). With DUP changes in exercise specificity occur daily.

Muscle fiber type, age and testosterone levels are the ultimate arbiters of how much muscle growth and strength you can achieve naturally. Fast Twitch (FT) fibers create more absolute power but have little endurance. Slow Twitch (ST) muscle fibers have more endurance but less absolute strength. Some FT fibers can become more like ST but not vice-versa. During lower intensity RT, only the ST fibers are recruited to perform. Higher intensity, >80% 1RM, and exercising to or close to failure recruits the FT fibers and elicits the most strength gains and muscle growth.

## The Single Set versus Multiple Set Controversy

The science of exercise physiology is clearly settled regarding the value of a periodization program to maximize RT gains. However, there are competing studies and opinions regarding the value of Single Set (SS) or Multiple Set (MS) routines in RT exercise. The conventional and majority opinion is that MS RT is a requirement to maximize gains. MS advocates believe you need to do three or more sets of each exercise to maximize strength or hypertrophy and many studies support this contention.

In contrast, SS advocates believe one high intensity, totally exhausting, single set can accomplish similar results. Note in execution, the single set is usually preceded by a warm up set. SS advocates can cite an impressive, albeit shorter list of studies supporting this contention. Even the MS advocates agree that beginners in an initial conditioning phase do

not progress any faster on MS routines. Post initial conditioning, the controversy is far from settled and is often heated between the two camps.



My take of MS versus SS can be summed up as, “it depends”. Without getting into specifics, studies of MS versus SS routines focus on different endpoints, measurements and definitions of success. You can cherry pick studies to reach the conclusion you desire.

**Foremost to consider** in exercise physiology is that the most unpredictable variable is the person. What are their objectives and time constraints? Are they adequately conditioned and do they possess the mental discipline to reach sufficient intensity for SS RT routines? How does their muscle distribution, fast twitch/slow twitch, respond to higher volumes versus higher intensity? What “feels” right to them leading them to do more of either approach. Know thyself!

## Nutrition

Pre and post exercise nutrition is another key to maximizing RT gains. In general, USDA guidelines recommend up to 1.2-1.5 grams of protein per Kg bodyweight for athletes. Focus on protein sources with a high concentration of Branched Chain Amino Acids, meat is high

but so is whey protein. I would advise men to avoid soy protein sources since they contain estrogenic analogs. For maximum gains, small meals eaten often will better keep your body in an anabolic state. Various supplements are promoted to aide muscle gain; the science is solid behind the value of creatine, much less so on other overhyped nutrients.

### Are you a jerk in the weight room?

The most common RT mistake is moving the resistance too quickly, particularly during the return or eccentric stage. Doing so cheats the muscle of the most beneficial aspects of the movement.

Immediately post vigorous RT exercise, it is vital to get your body out of its exercise induced catabolic state. Proteins are being taken, a process called remodeling, from other muscles to rebuild the muscle fibers worked and broken down during exercise. There is a demand for both glucose and protein to support this rebuilding process. Studies show intake of glucose (1g per Kg bodyweight) and protein in a 4:1 ratio within one hour is optimal.

There are many designer recovery drinks with this exact ratio. However, one study (Gilson 2009) showed identical results to the designer drinks with low fat chocolate milk that has a similar ratio. I also like an organic peanut butter sandwich for convenience, it yields a 2 or 3:1 ratio depending on the bread/peanut butter mix. Bottom line: EAT sufficient carbs and protein close to a 4:1 ratio ASAP after intense RT.

## Anabolic Steroids, Testosterone and RT

Testosterone (T) and its various forms is the ultimate anabolic muscle building hormone. Anabolic steroids are usually precursor substrates to T, the most effective ones have been outlawed but are still available. In practice, men use anabolic steroids frequently in the extreme body building ranks. Short term use has not proved any more dangerous than other extreme pursuits, IF not overdone and IF the substances are pure. Need I say it is not recommended by medical professionals or my certifying organization, the American Council on Exercise.

Any man undertaking this approach had better become very familiar with what is known as the Hypothalamus Pituitary Testes Axis (HPTA), aromatase enzymes, feedback loops and cycling. OTC legal aromatase inhibitors are another way to boost T.

Women taking steroids or other means to increase T are upping a predominately male hormone which is dangerous in too many ways to list, Google "East Germany Olympics Women Steroids".

The safest way to maximize muscle building T is to start RT early, in your late teens and early 20s. T levels decline as men age. Among other means, lower body fat and vigorous exercise boost T and the related anabolic substances Human Growth Hormone (HGH) and Insulin-like growth factor 1 (IFG-1). Running all out for 30 seconds induces a natural spike of HGH.

Physician supervised, prescription optimization of T for older men is gaining acceptance to improve overall health, muscle

mass, bone mass, fat loss, libido, cognitive function and mood. Fears that elevating T would increase prostate cancer incidence have proved groundless. Some anti-aging physicians are also prescribing HGH, but this is extremely expensive treatment and not as thoroughly researched.

**References:** Some below, more at my website, [www.newhorizonfitness.com](http://www.newhorizonfitness.com) see Exercise page of Library. I included some links to the best free web sites along with a list of books I recommend.

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