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Resistance Training Programs – Part 1

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In an attempt to always come up with the bigger, better and more effective training program, we often lose sight of the basics. With this in mind, however, even knowing the basics is not enough. They must be put into action. So, let us delve into resistance training programs and look for the hidden traps and some advance applications of the basics. This article will start with the general training parameters that make up training guidelines for resistance training.

Repetition Range

1 to 8 Reps

Training with very heavy weights (close to a 1RM load) in the low repetition range of six to eight or fewer repetitions results in strength improvements with a minimal effect on muscle mass. This is due to a high neural drive with a low stimulus duration. This follows the theories that neural factors contribute to the gains in strength. Generally, the upper end of this range (six to eight repetitions) is more effective for increasing mass than the lower end as stimulus duration is longer.

Relative strength athletes (those who lift their own weight for example when jumping or competing in weight restricted divisions) that require strength increases without increases in hypertrophic weight will benefit from repetitions in this lower range. More absolute strength (strength regardless of personal mass such as when tackling) would benefit from the higher range as this would increase strength both and muscle mass.

6 to 15 Reps

Training in this range stimulates significant muscle hypertrophy as hypertrophy requires both a moderately high neural drive (in order to activate the larger Type II fibres) and fatigue through muscle failure brought on by a sustained period of muscle stimulation.

With hypertrophy requiring both activation of neural drive and sustained simulation, manipulation of both of these parameters should be considered when prescribing a repetition range (e.g., 10 to 15 reps for weeks one through three and/or eight to 12 reps for weeks four through six as opposed to the mythical golden egg of 10 reps.

15+ Reps

Using 15 or more repetitions gains are made predominantly in the area of muscular endurance only as the duration of stimulus is high and the neural drive low.

Note: Repetitions in this range will provide little strength benefits. However, strength training (especially relative strength work) has been shown to improve endurance through improving muscle efficiency. For example, if you use 40 percent of your maximal latissimus dorsi strength in the pull phase of a swimming stroke, and your strength increases 40 percent of the increased strength = more power, alternatively if you only require a set output that previously required 40 percent contractile strength to provide the same output, the stronger muscle may only need to provide 30 percent. Both of these improve efficiency.

Set Range

Perhaps the grayest area in exercise prescription is how many sets to perform. The following points should be considered when determining set range.

As long as the intensity of effort is adequate, novices may require only one to two sets per muscle group in order to make gains. However, the rate of progression on such a low volume of training will start to decrease after a short period of several weeks. It is at this stage that increasing the set range to three to six sets per muscle group may stimulate more rapid increases in growth.

The quality of the sets must also be considered. If given 12 to 15 sets per body part (e.g., 3 x Bench Press, 3 x Push Ups, 3 x Dips, 3 x Inc Press), the quality and intensity of ALL of these sets must be questioned and would more than likely include sub maximal sets.

A rough guide for set prescription, based on experience, is shown below:

Experience			Suggested Set Ranges
0 to 6	Months		1 to 3 Sets
6 to 24	Months		3 to 6 Sets
2 to 4	Years	High Volume Training	5 to 8 Sets
		High Intensity Training	3 to 6 Sets
		For Maintenance	2 to 4 Sets
4+	Years	High Volume Training	6 to 12 Sets
		High Intensity Training	4 to 8 Sets
		For Maintenance	3 to 5 Sets

While it may have its place in a program, single set training also has its limitations. A key limitation lies in an increased difficulty to periodize volume and intensity with only one set (although it can be done).

Remember that more is not necessarily better. If a client can make gains with two sets by doing four, they may make no further gains from the additional two sets (Law of Diminishing Returns). However, the additional sets have increased the chance of overtraining and make progression harder and longer (e.g., from two to three sets versus from four to five sets).

Rest Periods

While many programs are fairly accurate in setting reps and sets, a considerable amount neglect the inclusion of set rest periods, failing to understand that rest periods have a strong influence on the metabolic application on set range.

As can be expected, the most appropriate rest would depend on the goals of the athlete. Goals requiring a duration of muscular tension typically utilize shorter rest periods and incomplete recovery, whereas goals requiring maximal effort require complete recovery.

Muscle Endurance

Muscular endurance training requires continued tension and maximal taxing of the local muscle's metabolic systems. With this in mind, rest between sets is kept to a minimum (i.e., no more than 30 seconds to two minutes).

Strength and Power

Power and strength training requires near maximal to maximal exertions in order to develop the neural drive. With the ATP - PCR system being the most powerful supplier of energy, it is used for these (maximal and near maximal) contractions. This system requires around three minutes to recover, and thus three minutes is suggested as the minimal rest period between strength and power sets. As fatigue in strength training is also related to other factors (e.g., CNS and neural drive), a slightly longer period is often utilized to allow these components (neurological) to recover. Some elite lifters have been known to rest 10 to 20 seconds PER repetition. Rest is a minimum of three to six minutes between sets.

For strength and power training, time must be provided to ensure that the next set is not attempted prior to full recovery, or training benefit will be decreased (e.g. failure to active Type IIB fibers). The amount of repetitions with the same weight will be lower and attempting a heavier lift will most likely end in failure.

Hypertrophy

Hypertrophy gains require a substantial duration of muscular tension, so rest periods are short. However, a high neural drive (stimulus) is also required and takes longer to recover. Therefore, a compromise between the two guidelines shown for endurance and

strength/power is required. With this in mind, a rest period anywhere between 30 seconds and three minutes may be utilized.

Although the rest range for hypertrophy is relatively broad, it must still be applied scientifically to optimize effectiveness. Thus, if completing reps in the heavier hypertrophy rep range to stimulate the neural drive and activate the larger fibers, recovery should match the weight. If completing six to 10 reps, the rest range would be around the two to three minute mark. If the aim was duration of stimulus, then for the 15+ repetition range, the rest period would be shorter (i.e., 30 seconds to one minute).

Recovery

Recovery can be viewed as the amount of time required for a muscle to recoup after its last training stimulus. It is important to note that a lack of sufficient recovery can lead to over training, injury and loss of training gains.

Like the other training parameters, the recovery time required between workouts is scientific (48 hours for a muscle group is standard, but is it?). Some impacting factors include:

- Training Load **-** Greater training loads require longer recovery periods, especially in advanced athletes who train close to their limits.

- Volume of Muscle Trained - The more joints involved in an action, the larger the volume of muscle trained and the longer the recovery.

- Quality of Recovery/Muscles Assisting in Other Exercise - During recovery, the degree of muscular activity influences the recovery rate. The less the target muscle is used, the greater its recovery. Therefore, during a muscle's recovery, it should be used as little as possible. This includes use as a fixator, synergist or prime mover.

  This is an important and often neglected concept. Consider the triceps muscle. It is a prime mover in most compound chest exercises (i.e., elbow extension in pressing actions). Likewise, it is used in pressing actions for the shoulders (again, as an elbow extensor in pressing as during a shoulder press), and then it is trained as an individual muscle, but we have yet to discuss its synergistic/fixator role in stabilizing the scapula via concepts like concurrent shift.

    - Day 1: Chest and Back
    - Day 2: Shoulders and Abs
    - Day 3: Legs and arms

  Looking at the above program, there is also a problem with volume of work. If chest is trained one day for three sets, shoulders the next for three sets and triceps the one after for three sets, the triceps (a relatively small muscle) are subjected to nine sets of training over three continuous days, and yet the larger chest gets only three sets of training over one workout. The triceps become over trained and fail to adapt, so many practioners then do more triceps training to overcome the "lag."

- Contraction Speed and Degree of Eccentric Activity - There is a distinct difference between strength and power exercises as is the amount of recovery required after a training session. Athletes training for muscular power will most often employ fast to moderate contraction speeds and sub maximal resistance. Recovery times for this type of training are reasonably short, and these methods can be utilized to train the same muscle group on consecutive days. In contrast, strength athletes often lift at a slow to moderate pace against the heaviest resistance possible. They are more likely to require several days rest between workouts for the same muscle group.

  In accordance to the Force-Velocity Curve, the amount of intra muscular tension created during faster contractions is low compared to that created at the slow end. It is presumed that more muscular "damage" is incurred during slow speed strength training. Therefore, a longer recovery is required.

  Furthermore, the extent to which eccentric contractions are employed also influences recovery times. For example, some athletes do not employ eccentric activity (they drop the weight once it has been lifted or throw the weight), and therefore, their recovery need is lower. Likewise, those who use a high volume of eccentric loading (e.g., a breaking force, pushed against in a scrum, catching a heavy object, jumping down from a height, heavy weight lifting, running down hills, etc) have the potential to do more muscular damage and hence require a longer recovery time.

The general rule is to allow a muscle group at least 48 hours to recover between successive workouts with power training being the exception. Having just revised the general training parameters that make up training guidelines for resistance training, the next installment in this series will look at application into a resistance training program.