



Five Steps to Increasing the Effectiveness of Your Strength Training Program

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Overtraining and periodization are among the hottest topics in the field of strength training. In the past, strength coaches borrowed most of their training methods from the Iron Game. This is why not too long ago, and probably still today, the over-zealous coach would design a program made up of the Bulgarian pulling cycle, Bill Kazmaier's bench press routine, and Arnold Schwarzenegger's blitz your biceps workout. Then came the concept of periodization and the Russian weightlifting system with its percentages progression. Fortunately, the present field of

strength training has progressed tremendously over the last few years and has much more to offer in the area of program design.

The goal of this article is to offer strength coaches five steps to help athletes achieve physical superiority by solving the following problems:

- The “Wanting it All!” syndrome
- The “General Strength vs. Specificity” debate
- Undertraining vs. Overtraining

Step 1. Alternate Accumulation Phases with Intensification Phases

To force the neuromuscular system to adapt to a training load, it is of the utmost importance to plan variations in both volume and intensity of the load (5). Because the body adapts very rapidly to the stress of training load, strength training programs lose their efficiency after only two weeks (22, 31).

To maintain increases in maximal neural activation, training intensities must be periodically varied or kept at progressively increasing levels. That is, if the stimulus is always presented to the body in exactly the same way, its efficiency will diminish. Unfortunately, in North America, very few strength coaches are aware of this concept, which is why their programs produce much less than optimal results. To progress quickly, phases of high volume (a.k.a. accumulation, extensive loading), phases of high intensity (a.k.a. intensification, intensive loading), and phases of unloading must be alternated.

A common mistake seen in strength training programs is linear intensification; that is, moving ever increasing intensities. For example, the athlete will go through a progression of monthly blocks, such as the type illustrated in Table 1. In this design, the intensity moves in a linear fashion to 75, 85, 90, and 95 percent maximum.

Weeks	1-4	5-8	9-12	13-16
Reps	10	5	3	2
Sets	5	3	3	3
Intensity	75%	85%	90%	95%
Volume (total reps)	50	15	9	6

Table 1: Standard linear intensification of training in strength development

A few problems arise with this form of training:

- The intensity is continuously climbing up, creating ever-increasing levels of stress and thus allowing very little time for regeneration.
- The hypertrophy gained through the first month of training may not be maintained in periods where sets of five repetitions and fewer are performed. Why? Because volume is a prerequisite for optimal muscle mass increases.

Table 2 offers an alternative solution, such that both the volume and the intensity are presented in an undulatory fashion. In this example, the volume decreases at a much slower rate while the intensity increases in a more gradual fashion. The phases are much shorter, allowing for a more frequent change of stimulus that is highly inductive to strength gains. This system is quite popular with weightlifting coaches of Eastern Europe, West Germany, and Canada.

Weeks	1-2	3-4	5-6	7-8	9-10	11-12
Reps	10-12	4-6	8-10	3-5	5-7	2-3
Sets	3	5	4	5	4	6
Intensity	70-75%	82-88%	75-78%	85-90%	80-85%	90-95%
Volume (total reps)	30-36	20-30	32-40	15-25	20-28	12-18

Table 2: Alternating accumulating and intensification phases for strength development

Because linear overloading is not advisable, the undulatory approach should offer a more rewarding alternative (2, 27). According to Schmidtbleicher (26), strength potential is reached faster if methods favoring the development of muscle mass are used first, followed by methods favoring motor unit activation enhancement (i.e., nervous system training).

Athletes must force adaptation of the neuromuscular system through volume and then stimulate it through intensity. Such training variety eliminates the physiological and psychological causes of training plateaus caused by an overemphasized specialization on volume or intensity. In this manner, strength and muscle mass can be built at higher and faster rates.



Weightlifters must focus on methods to increase maximal neural activation. Shown is Bulgaria's Yanko Rusev. Rusev broke 25 world records, won five World Championships, and in 1980 captured Olympic gold. At a bodyweight of 165 pounds, Rusev clean and jerked 460 pounds. (This photo, and the lead photo of powerlifter Doug Young, by Bruce Klemens.)

Step 2. Vary the Forms of Muscular Contraction

Variety in strength training is a critical factor in maximizing the training response; unfortunately, it is often the most overlooked of the training principles. Gains in strength come about faster if many types of contractions are used instead of only one (29, 42). Soviet National Weightlifting Coach A.K. Worobjow recommends the following proportion between the different types of contractions for optimal strength development: 70 percent concentric, 20 percent eccentric, 10 percent isometric (41).

Eccentric training allows athletes to reach the highest levels of muscular tension (19), which in turn favors greatly the development of hypertrophy and strength (14, 20). It has been shown, many times over, that different combinations of concentric and eccentric training increase maximal strength faster than if concentric training is used alone (13,29). Here are some of the advantages of eccentric training:

- It can induce more strength and muscle mass gains than concentric or isometric methods alone, allowing athletes to break through strength-gain plateaus.

-- Fast eccentric work (e.g., plyometrics) cause force-time curves shift to the left, resulting in higher rates of force development.

-- Because of the very high loads used with eccentric training, such as with maximal weights method, there is an impact not only on the muscle but also the nervous system.

-- Eccentric training can take various forms, including the following loading pattern for an accumulation phase:

A. 4-6 sets x 4-6 reps at 110-120%, 8-10 seconds eccentric, rest 4-5 minutes between sets

In contrast, an intensification phase eccentric workout could follow this loading pattern:

A1. 1-2 sets x 3 reps at 125%, 3-5 seconds eccentric, rest 4-5 minutes

A2. 1-2 sets x 3 reps at 132.5%, 3-5 seconds eccentric, rest 4-5 minutes

A3. 1-2 sets x 2-3 reps at 140%, 3-5 seconds eccentric, rest 4-5 minutes

-- Use specially designed equipment to increase the eccentric loading, such as eccentric hooks.

-- At the end of a conventional concentric 4-6 RM set at 80 to 82 percent of 1 RM, additional eccentric work can be performed by adding 25 to 30 percent more weight to the concentric training poundage on the barbell and performing additional eccentric-only repetitions. Instead of adding weight, a training partner can manually apply resistance (such as by pushing down on the barbell during a bench press) during the eccentric portion of the lift. These additional negative reps will exhaust eccentric strength levels after achieving concentric muscular failure. This method applies more to an accumulation phase, as this is where strength gains through hypertrophy are desired. However, the athlete must be able to control the descent of the resistance selected, or injury can occur.

Even though eccentric training shows great potential for strength improvement, these guidelines should be followed:

-- It should only be practiced after one to two years of a solid base of strength training.

-- Due to the high levels of muscle soreness experienced with this type of training, training frequency with this method is limited to once every 7-10 days. Eccentric training can increase the probability of overtraining and, therefore, be used sparingly. Further, it is not recommended during a competitive season because it severely hampers recovery time.

-- Slow eccentric training has been associated with a reduction in the rate of force development (14), suggesting it should be used mainly in the preparation period (off-season), while fast eccentric training should be reserved for the competitive period (pre- and in-season).

-- It often requires the help of one or two partners or special equipment to help move the resistance during the concentric range. Eccentric training can be hazardous during certain weight training exercises, such as squats, if the spotters are not properly trained.

-- Isometric contractions are more specific to sports such as wrestling and gymnastics than football or soccer, but can be used to break through strength gain plateaus in predictor lifts. Because 10-15 percent higher levels of force can be produced with isometric contractions, this form of work can be periodically used to favor the growth of strength levels. Here are examples of how to focus on isometric contractions:

a) An athlete can perform a functional isometric contraction after pre-fatiguing the muscle with 4-6 partial reps; a power rack is needed with this method. After a regular warm-up, select a weight the athlete can move from one set of pins to another; for example, from midpoint to six inches before lockout in bench press. Perform 4-6 RM and at the end of the last concentric repetition, contract isometrically with maximal tension against the top pins for a count of 6-8 seconds. Then lower the barbell and attempt another repetition. If the athlete can perform another rep, the weight is too light.

b) Isometric work can prolong the intensity and duration of a conventional set carried to concentric muscular failure. Let's say an athlete has just completed the last concentric portion of a 6 RM set of barbell curls. He or she would lower the barbell 30 degrees, stop for a count of eight seconds, and repeat the process at two other angles.

c) Isometric stops can be incorporated into the dynamic range of a movement. For example, 6-second holds can be performed at various points in a clean pull: two inches off the floor, just below the knee, and at mid-thigh.



Eccentric overload can be achieved by having a training partner apply manual resistance to the barbell during the lowering phase of the exercise. (Photo by Miloš Šarčev)

Step 3. Strengthen All Aspects of the Force-Velocity Curve

In North America, there are conflicting schools of thought on the optimal speed that strength work should be performed. One school advocates high velocity training, while another contends that strength gains can optimally be gained through only slowly performed repetitions. Both schools are correct! Muscles gain faster in strength if trained at various speeds than if always trained at the same speed (3, 41).

It's also important to understand that speed of contraction has a specific training effect on the neuromuscular system. Because moving high loads at slow speeds eliminates the use of momentum to lift the resistance, training at slow speeds has a definite advantage over high-speed lifting for the development of maximal strength (1,6). Slowing down the movement (3-10 seconds for each eccentric phase) augments both the duration of the stimulus and the levels of tension imposed on the muscle. This favors a faster development of tension imposed on the muscle that causes faster development of strength and muscle mass.

When training at slow speeds, no more than 60 seconds of work should be performed per set. For example, if the speed of movement is decreased to the point where it takes 6 seconds for each concentric and each eccentric portion of the lift, no more than 5 repetitions per set should be performed [$5 \times (6 \text{ seconds concentric} + 6 \text{ seconds eccentric}) = 60 \text{ seconds}$].

Training at slow speeds raises the force-time curve, while training at high speeds shifts it to the left (35, 13, 15, 28). Although training explosively with higher loads does not produce high increases in strength, it is highly beneficial to train the nervous system to create a positive adaptation of the rate of force development. Emphasizing the early part of force development is done for the following reasons: (a) it is advantageous in terms of synchronization, and (b) it is relevant for practical purposes, because the actual time available for muscles to contract in athletic activities is very short (21).

A slow velocity of execution is associated with the production of high forces. In contrast, high velocity movements favor high levels of neuromuscular output. Thus, a weight that is light enough for power training is not heavy enough for strength training (24). That said, for the first year of an athlete's strength training, European weightlifting coaches recommend the use of slow (30 degrees per second) to moderate (60 degrees per second) tempos of execution.

While strength training at high speeds is specific to the rapid movements performed in sports such as football and soccer, it must be done only after obtaining a solid base of maximal strength. The latter can best be obtained through slow movements. Movements in the general preparatory phase should therefore be of moderate to slow tempo and with a variety of types of contraction, and a gradual "speeding up" of the movements as the competitive season approaches to train the nervous system specifically.

Step 4. Use a Wide Selection of Exercises

Changing the nature and form of the exercise is another way to gain strength faster while eliminating boredom. Further, varying only the volume and the intensity in your strength training program is not enough to achieve optimal results. This is because the order of recruitment of motor units is fixed for a muscle while performing a given movement, even if the rate of force development and speed of contraction change (8). However, the order of recruitment can be changed with a shift in body position (28) or in the case of a multi-functional muscle accomplishing different movements (8, 11, 34).

Certain motor units within a muscle have a low recruitment threshold for exercise X and a high recruitment threshold for exercise Y. This variation in recruitment order may be partially responsible for the specificity of training that has been observed (33). It may also support the notion long-held by bodybuilders that full development of a muscle is possible only when all its possible movements are trained (32).

There is a wide variety of strength training exercises available to the strength coach. Exercises that strengthen the hip and knee extensors, for example, can be performed with various training implements (Olympic bars, dumbbells, trap bar, iron circle, or machines). Furthermore, starting positions for certain exercises can be changed. Using the example of a football lineman performing clean pulls to improve his hip and knee extension power, they can be done on a podium, from the floor, from the blocks, from the hang, from mid-thigh, and so on.

Partial range of movement work is an excellent form of training that is, without a doubt, not used enough. For example, strength and conditioning coaches know that tremendous amounts of weight can be handled in the lockout position of pressing and squatting exercises. However, the

resistance needed to perform full range exercises is not sufficient to overload these strong points in the strength curve; hence, the usefulness of power rack training. With the power rack, the athlete can select specific parts of the range of motion and use optimal loads for those specific ranges of motion. Blocks of various heights can be used for performing the many varieties of the Olympic lifts.

Changing the diameter of the grip can be a challenging training stimulus. Try performing chins or curls with oversize bars for a new kind of training effect for the elbow flexors. Tape, foam, plastic pipe, or a combination of these can be used to thicken your bars.

Varying the exercises using the above methods will also ensure that the athlete is strong in all planes of movement. Often athletes are overconcerned about having a “Big Bench.” Instead, why not be good in all forms of presses and have a shoulder structure that can apply force at any angle? In fact, this approach may enable him to attain that “Big Bench” faster, reduce the risk of overuse injuries, and prevent boredom.



Changing body position, such as by lifting your hips during a leg extension, is one way to ensure variety in training.
(Photo by Miloš Šarčev)

Step 5. Forget about Percentages

Often strength training programs follow a system where various percentages of maximum are used. This method has serious drawbacks:

-- Strength varies 10-20 percent over the course of a single day (39). Therefore, if you tested the 1 RM at 5:00 PM, the percentage prescribed for an exercise being performed at 11:00 AM might be inappropriate.

-- Even though the relationship between the 1 RM and submaximal loads has been established with a fair degree of precision, individual differences due to neural factors and fiber typing can deviate greatly. For instance, while most individuals usually perform 11-12 repetitions at 70 percent of a 1 RM, one individual on the Canadian National Judo Team could perform 24 repetitions at this percentage.

-- The percentage relationship between the maximum and submaximal repetitions is different from one muscle to another (17). It has been shown that at 60 percent of maximum, 40 repetitions can often be performed on the leg press while only 11 reps may be done on the leg curl (30).

-- Percentages don't allow for individual training responses. Some gifted individuals respond quickly to strength training programs and might be undertrained with fixed percentages, while other individuals can be overstressed with these percentages. This latter type of individual might be tempted into cheating to complete the prescribed number of reps at a given percentages to keep up with his peers. Furthermore, if he or she doesn't cheat, they might be discouraged because they cannot keep up with their teammates. Different recovery abilities between athletes are also an important factor. What is the alternative? Simple: Let the reps dictate the load, not vice versa, which can be done by using an intensity zone spread that is controlled by a fixed amount of repetitions (such as 6-8).

Let's say your athlete is in a phase where they are working in a 4-5 repetitions range. If your athlete can perform 7 reps or more, the weight is too light and should be increased for the following set. If your athlete can do 3 reps, the weight is too heavy and should be. In this manner, you will at least control the duration of the stimulus imposed upon the muscle. And because the intensity of the contraction is inversely proportionate to the duration of the stimulus, you will have a good idea of the intensity at which your athletes are working. Furthermore, providing that multiple sets are performed, you will be able to individualize the optimal resistance for every athlete for that particular day. In this fashion, factors such as time of day, will be taken into account in your training program.

In addition to having your athletes fill out an individual training diary, have them fill a training station diary, which is a log at each lifting station. This diary will allow you, at a glance, to assess the effectiveness of your program because you will be able to compare the athlete not only against himself or herself, but against others.

The proponents of the percentage method will argue that it prevents overtraining. Perhaps, but why perform 5 sets x 5 reps at 70 percent when you can perform 12 reps at this percentage? If you are concerned with overtraining, cut back on the amount of sets or exercises. Your body is well equipped to protect itself against intensity of work, but not against volume of work. If a set is not a warm-up set, why waste it?



The percentage relationship between maximum and submaximal repetitions depends on the muscle groups recruited and the exercises performed. For example, more reps can be performed at a given percentage of an athlete's 1 RM with the leg press than the leg curl. (Photo by Miloš Šarčev)

Final Thoughts

There are many ways to vary workouts in a logical and progressive manner to develop athletic fitness. It is up to you to design strength training workouts for your athletes while considering all the factors that affect program design: training age, equipment, recovery time, and so on. Incorporating variety into your workouts, such as by using the five steps described in this article, can do wonders for your program.

Variety is the spice of life, and there is no reason not to add a little spice to your training programs. Don't be afraid of being an innovator, and don't train to train -- train to win!

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