

Strength Training: A Primer (Including Calories Burned During Exercise: Part 2)

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About Strength Training

“Strength training” are easy words to say, but less easy to understand. So, let’s start by clearing up some common misunderstandings.

First, there are a lot of people who think that if they engage in strength training they will get big, bulky muscles. Guys: *you won’t*. Gals: *you can’t*. Developing large, exaggerated musculature is only possible by training in a very specific manner which goes way beyond how you will exercise for a strength component to a well rounded physical fitness program.

Also, big, exaggerated muscles require lots testosterone. Men have it, but not usually in amounts associated with bodybuilding, and women typically produce only about one-tenth the amount of testosterone as men. It is a fact that virtually all bodybuilders use muscle-enhancing dietary supplements, and many bodybuilders, both men and women, use illegal anabolic steroids as well.

Charts and Guidelines at the end of this article:

- Calories Burned During Strength Training
- Exercises by Muscle Group
- Ratings of Perceived Exertion

So, if you’re concerned about developing oversized muscles, stop worrying. What you *will get* from fitness strength training is a firmer, stronger body that is more functionally efficient, more aesthetically pleasing, and burns more calories all day long.

Another major point of confusion is about the exercises themselves. This is because strength exercisers use many of the same exercises, and some of the same equipment, as bodybuilders. That’s because bodybuilding – both in its purest form and in its wannabe form - has been around for a long time, and fitness strength training is relatively new. Only recently has the fitness community understood the substantial benefits of strength training as a crucial component of physical fitness. As a result, much of the information that you get from strength training websites is focused on bodybuilding, not fitness exercising. But, bodybuilding, as you will soon see, is an entirely

different training approach from fitness strength training, even though many of the exercises and some of the equipment used are the same.

Resistance Training Modalities

Essentially, there are four totally different strength training models:

- Olympic weightlifters and powerlifters
- Bodybuilders
- Recreational weightlifters
- Fitness exercisers

This article is about strength training for fitness exercisers.

Lest there be confusion, let me briefly describe what each of the four strength training interests are about so that you will know what fitness strength training really is and what it *is not*:

Olympic Weightlifting and Powerlifting

Olympic weightlifters are very large people who compete on the basis of absolute, explosive strength. They are judged on their ability to perform one single repetition, using three separate attempts, of two different lifts: the "snatch," and the "clean-and-jerk." The snatch is lifting a barbell from the floor to an arms-extended overhead position in one single movement. The clean-and-jerk is similar, but the lift is in two stages: floor to shoulder height, and then shoulder height to overhead. The guy (and gal) who can lift the most weight within his and her weight class wins.

Powerlifting is similar to Olympic weightlifting, except that contestants are judged on absolute strength as demonstrated on three different lifts: squat, bench press, and deadlift.

Olympic weightlifters and power lifters are to resistance training what linemen are to the NFL; not the prettiest to see, but absolutely the strongest, most powerful guys on the field.

Bodybuilding

Whereas atrophy is a decrease in the size of muscle tissue from disuse, hypertrophy is just the opposite: an *increase* in muscle size; within the context of this discussion, hypertrophy is the increase in muscle size as a result of exercise.

Bodybuilders embrace a strict protocol of exercise, food choices, nutrient-timing, and dietary supplements – some legal and, often,

some not. Their aim is to gain as much muscle mass as possible, and to have as little body fat as possible, so as to accentuate the definition of their exaggerated musculature. Few bodybuilders engage in any form of cardiovascular exercise, relying on weightlifting as their sole exercise mode.

Bodybuilders follow rigid workout routines. They may workout as much as six days a week, devoting each workout to a single muscle group, performing multiple sets of multiple exercises for just that day's target muscle group. While this may be extreme, most bodybuilders will workout at least four days a week, devoting each workout to not more than two muscle groups. A typical four-day "split" program might be:

- Day 1: back and biceps
- Day 2: chest and triceps
- Day 3: thighs and abdominals
- Day 4: shoulders and calves
- Day 5: recovery (day off), then repeat the 4-day split

"Mister America" and *"Mister Universe"* are the best known examples of competitions for bodybuilders, and Arnold Schwarzenegger (then, not now) is the best known example of the look that bodybuilders strive for. Whereas Olympic weightlifting is about how much weight you can lift, bodybuilding competitions are about how you look in your Speedo – posing versus lifting.

Male physique models and female bikini models follow similar protocols as bodybuilders, of which they are a subset category – just not to the same extreme.

Recreational Exercisers

Recreational exercisers are committed exercise enthusiasts. This class includes adherents to all forms of exercise, from yoga and Pilates, through running, and, of course, strength training. Most recreational exercisers specialize in just one form of exercise, though it is not uncommon for many to cross-train, which is to engage in two or more different types of exercise.

Recreational exercisers are serious about their exercise commitment. They are generally well informed about advanced-level training techniques and set high standards for themselves. Runners, for example, often participate in 10-K, and even marathon races;

recreational strength trainers follow many of the same training techniques as bodybuilders, but without the extreme diet and supplement regimens, and without the hyper-exaggerated muscular look. Also, while bodybuilders live within a culture that is specific and unique to bodybuilding and the bodybuilding community, recreational weightlifters have regular lives outside of their time in the gym.

Yet, despite the foregoing, recreational exercisers are quite the mixed lot. The one common thread they all share is that they exercise because they want to, not just because they think they should.

Fitness Exercisers

Optimum physical fitness is defined as possessing optimal levels of cardiovascular endurance, muscular strength and endurance, a full range of motion (flexibility), and achieving and maintaining an ideal body weight as determined by body composition, which is the ratio of lean body mass to fat mass (aka body fat). Body composition is a better indicator of healthy body weight than scale-weight alone.

In an earlier article, we explored calories burned during walking. Walking promotes both heart-health and weight management. This article discusses calories burned during strength training (p.29). But more than that, it is a primer on the subject of strength training as part of an overall fitness program.

Why Strength Training

Strength training, as the term suggests, is exercising your muscles to make them stronger. Benefits of strength training include:

- **Increased bone density.** Bone adjusts its strength in proportion to the amount of stress placed on it (*Wolff's Law*). Regular strength training increases bone density as a result of increasing collagen fibers and mineral salts, whereas sedentary individuals lose bone density over time as mineral salts are withdrawn.
- **Increased physical capacity.** The stronger you are, the greater your capacity to perform physical tasks, including activities of daily living. Previously untrained individuals of both genders will typically gain 2 to 4 pounds of new muscle, and increase their strength by 40 to 60%, after just two months of regular progressive strength training.
- **Enhanced physical appearance.** Body composition – the proportion of your body-weight that is *not fat*, versus the proportion that *is fat* – plays a major role in how you look.

Sedentary individuals can expect to lose 1½ pounds of muscle *every year*, after age 25. Strength training leads to an increase in muscle mass in previously untrained individuals and preservation of muscle mass in those who train regularly. If John and Sam each are 5' 10" tall, and both weigh 175 pounds, but John's weight is based on 25% body fat while Sam's body fat is 15%, Sam will definitely look leaner and fitter. Muscle weighs 17.7% more than an equal volume of fat. Said another way, 10 pounds of fat occupies more space on your body than 10 pounds of muscle, just like 10 pounds of feathers occupies more space than 10 pounds of bricks. Therefore, if you gain 10 pounds of muscle and lose 10 pounds of fat, your scale-weight does not change, but your appearance (and your health) does. In fact, it is possible that you can actually *gain* scale-weight while coming down in size; trust your tape measure, mirror, and clothing fit – not your scale.

- **Improved metabolic function.** Muscle is metabolically active tissue, while fat is so minimally active as to be almost inert. Put another way, your body uses three times more energy (calories) to maintain muscle than it does to maintain fat, so the more muscle you have, the more calories you burn. Indeed, muscle accounts for 25% of all calorie use, even during sleep.

Sedentary adults can expect a 5% reduction in metabolic rate every decade as a result of muscle loss. A reduced metabolic rate corresponds to an increase in body fat, even when there has been no change in diet. And as discussed in the previous section, your appearance will change, even if your scale-weight stays the same.

This muscle loss is largely a result of becoming less physically active as we become older. As increased work and family demands compete for our attention, it is easy to feel uninspired to set aside time for regular exercise.

It is in our nature to subordinate the familiar to the immediate. And so it goes with things like exercise: you know you should do it, but there are always more pressing things to do than maybe extend your life and to improve your health, reduce your physical limitations, and enhance your personal appearance; after all, you didn't almost die yesterday, and you probably won't almost die tomorrow, so there's no special need to commit to an exercise program today. Sound familiar? But, *30 todays* is a month, and *365 todays* becomes a year. Please don't wait until your doctor tells you that you need to include exercise as part of your post-event rehabilitation therapy. (Preachy part over.)

Strength Training for Fitness Exercisers

Strength training is the generic term for all forms of exercise which involves resistance as the primary component. This includes resistance training with free-weights (principally dumbbells and barbells), various kinds of machines, such as those found in gyms and health clubs, resistance bands and tubes, and exercises relying solely on body-weight (push-ups, chin-ups, crunches, etc.).

The concept of resistance in the context of exercise means first applying *force against resistance*, and then applying *resistance against force*. An example would be raising and lowering a dumbbell to perform a biceps curl. During the raising phase you are applying force against the resistance of the weight of the dumbbell. During the lowering phase, you are applying resistance against the force of gravity.

I use the biceps curl as an exercise example throughout this article – not because it is an important exercise, but because most people know what it is, which makes it easy to follow the points being made when it is used as an example.

Glossary

Before going further, let's look at a glossary of resistance training terms so that it will be clear as to what is meant when you encounter them later.

<i>Glossary is not in alphabetical order to maintain relevance with certain terms which relate to other terms.</i>	
Resistance	1. Synonymous with strength training, i.e., resistance training." 2. Any load, regardless of source (weights, bands, machines, body-weight) that poses a challenge to the muscles.
Concentric	The lifting, or raising, phase of an exercise repetition. The principle muscle involved contracts, thereby <i>shortening</i> in length – viz – as in flexing your biceps.
Eccentric	The return, or lowering, phase of an exercise repetition. The principle muscle involved <i>lengthens</i> as the contraction is reversed, returning the muscle to its pre-contraction position.
Repetition (aka "rep")	One single completion of the concentric and eccentric portion of an exercise. Example: raising and lowering a dumbbell one time is one repetition.
Rep Range	The minimum and maximum number of repetitions of an exercise you plan on performing using the same intensity or resistance. The minimum number of reps is usually the starting point for a given resistance. The number of reps performed increases to the maximum number as you become stronger over time. A rep range of 8-12 means that you are working with a resistance that you can perform at least 8 repetitions, but not more than 12.
Progression	Moving up to a greater resistance level once you have fully adapted to a current resistance level and can perform more repetitions than called for in your planned rep range.
Tempo (aka velocity)	The speed of each repetition. Example: 2 seconds <i>up</i> , 1 second " <i>squeeze</i> ," 2 seconds <i>down</i> .
Set	The number of repetitions of an exercise performed without stopping for rest, or before performing the next exercise. Example: performing 12 repetitions of a biceps curl without stopping is a 12 rep set.

Compound Exercises	An exercise that requires moving against resistance through <i>two or more joints</i> . This results in the involvement of all or some of the muscles associated with each joint. There are more than 600 muscles in the human body. Performing compound exercises permits the training of <i>multiple muscles</i> at one time. Example: The squat exercise works the quadriceps, hamstrings, calves, glutes, low-back, and core.
Isolation Exercises	An exercise that involves movement against resistance at <i>one single joint</i> , limiting muscle involvement to all or some of the muscles associated only with that joint. Example: The leg extension involves only the knee joint and works only the quadriceps muscles.
Hypertrophy	An increase in the size of a muscle; the opposite of atrophy.
Lift (lifting)	A generic movement term for resistance exercise. Actual movements could involve executions that are not technically "lifting" (e.g., pushing, pulling, lowering, etc.).
Lean Body Mass (aka "LBM")	Lean body mass is that part of total body weight that is not fat. It includes muscle, bones, organs, body fluids, and foods ingested but not yet eliminated.
Mass	Refers to muscle tissue, aka "muscle mass." Muscle mass (physiology) is not to be confused with "massive muscle," which is a subjective term typically used by or about bodybuilders.
Failure	The point at which you can not perform one more repetition within an exercise set while still maintaining proper form and tempo. <i>Absolute</i> failure should not be attempted without a "spotter," or exercise partner as a safeguard against injury. <i>Volitional</i> failure is voluntary failure, stopping when you feel that you cannot do more, but without actually trying to do so.
Valsalva Maneuver	<i>Danger!</i> The Valsalva maneuver is when you hold your breath while exerting force, such as during the concentric (lifting) phase of a resistance exercise, causing pressure both on the inside of the eardrum and in the thoracic cavity, impeding blood flow back to the heart. Performing the Valsalva maneuver during exercise poses a serious risk, especially for those with high blood pressure, and those who may have a hernia.

Circuit	Completing the exercise session by moving from one exercise to the next, with little or no rest between exercises. A full-body strength circuit typically consists of 8 to 10 exercises, covering each of the major muscle groups. There are also cardio circuits and circuits that combine strength and cardio components.
Recovery (aka "rest")	<p>1. The resting period between sets, or the resting period taken before moving from one exercise to the next. Rest periods of 30 to 120 seconds are sufficient. Less than 30 seconds may not be adequate rest before performing the next set or exercise, and more than 2 minutes allows the muscles to cool down (not desirable), as well as extending the duration of the workout session.</p> <p>2. The recovery period taken between workout days.</p>
Active Recovery	<p>1. Instead of resting between sets, moving immediately to another exercise involving a different muscle group. (This only applies when performing more than one set of the same exercise, or more than one exercise for the same muscle group.) Example: chest exercise followed immediately by a leg exercise without resting between the two exercises before returning to the chest exercise.</p> <p>2. Instead of resting between exercises, perform stretching movements for the muscles just stressed by exercise.</p>
DOMS	"Delayed onset muscle soreness." Muscle soreness from exercise. DOMS is usually experienced the next day, or the second-next day, following an exercise session. DOMS is more typically experienced by those new to exercise than those who are regular exercisers, or after performing unaccustomed exercise activities. DOMS may last up to 96 hours. Treatment, for those who can tolerate them, include over the counter NSAIDs, such as aspirin, ibuprofen, and naproxen. Proper warm-up and stretching activities may also help prevent or minimize the effects of DOMS.
1RM (etc.)	"One-repetition maximum." The amount of weight or resistance that you can lift with correct form and tempo only 1 time. Other maximums are similarly expressed, e.g., 8RM, 12RM, etc.

EPOC	"Excess post-exercise oxygen consumption." Also known as the "after-burn." EPOC is the increased oxygen requirement which continues after the exercise session has finished. This has the effect of increasing the metabolic rate for a longer time than the duration of the exercise session itself, and is one way that strength training promotes weight loss/weight management.
Core	Not an individual muscle, and not as popularly thought of as just the abdominals, but all of the muscles of the trunk, including the back, abs, and pelvic region. These are the muscles that stabilize positioning of the spine and pelvis.

Fitness Strength Exercise vs. Bodybuilding

While fitness exercisers use some of the same exercises as bodybuilders, they are done at *lower intensity* levels and far *fewer times*. Also, whereas bodybuilders perform what are known as either "straight sets" or "super sets," fitness exercisers will typically perform "*circuits*." Straight sets means that if the routine calls for, say, three sets of biceps curls, those sets are performed consecutively, with rest between sets, before moving on to the next exercise.

Major Muscle Groups and a Suggested Order of Exercise:

- Quadriceps
- Hamstrings
- Calves
- Chest
- Back
- Shoulders
- Biceps
- Triceps
- Low-back
- Abdominals

As mentioned, fitness exercisers will usually perform full-body exercise routines in a circuit-training fashion. This means performing one set of each exercise, preferably in the order of the largest muscle groups before the smaller muscle groups, such as the upper legs, back, and chest, before the smaller muscles, like the shoulders, arms, and abs.

Another major difference is that fitness exercisers need only perform one complete single-set circuit (8 to 10 exercises involving each of the major muscle groups). Research tells us that a single-set routine will reap 80 percent of the benefits of multiple-set routines, which is sufficient for significant fitness gains and maintenance. One complete circuit generally requires 20-30 minutes. Add to that a 5 minute warm-up and a 5 minute cool-down, and 5-10 minutes of post-cool-down stretching, and you are finished in under an hour.

And yet another difference is that whereas bodybuilders perform a lot of isolation exercises in order to intensify the efforts directed at an individual muscle group, fitness exercisers will perform a majority of compound exercises. Some of the benefits of compound exercises include:

- more calories expended during and after exercise (EPOC)
- more closely resembles real-world body movements, thereby enhancing strength and coordination for everyday functional activity
- faster workout times as more muscles are exercised at once

- improves balance and stability at the joints
- raises heart rate during the exercise session better than isolation exercises, adding a cardiovascular component

The FITT Principle

FITT is an acronym for **f**requency, **i**ntensity, **t**ime, and **t**ype. In essence, applying the FIIT principle to exercise is how trainers design programs for their clients. While exercising in any form is certainly better than not exercising at all, a well-designed exercise program is substantially more effective at addressing individual goals, such as weight loss, cardiovascular endurance, and functional strength.

Also, some physical conditions, such as certain postural deviations, arthritis pain and low-back pain can often be improved through exercise.

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Personal trainers do not perform medical assessments or make determinations with respect to exercise prescription for medical conditions, nor am I attempting to do so here. Trainers work in conjunction with healthcare providers to implement exercise guidelines provided by the clients' physician. Nothing in this article is intended as a substitute for physician-directed care for those with medical conditions that classify them as anything other than "healthy adult."

▪ Frequency

Frequency refers to how often you exercise. More specifically, how many times you exercise each week. Frequency of strength training is important: exercise too frequently and you will suffer both mental burn-out and musculoskeletal overuse injuries; exercise too infrequently and you will not elicit a sufficient adaptive response necessary for increasing, retaining, or restoring muscle mass. Also, if weight management is a goal, you will be losing important opportunities to burn calories during exercise, not to mention forfeiting all the extra calories you could be burning 24 hours a day from new muscle that you could be adding but aren't.

Also, while strength training should never replace the cardio component of your overall fitness program, positive cardiovascular adaptations can result from performing strength training circuits lasting at least 20 minutes, with minimal rest between exercises. Cardiovascular fitness is measured in terms of maximum oxygen consumption (VO₂max), which improves with training. Circuit training can lead to a 5-10% improvement in VO₂max.

There is also an important mental aspect that comes from exercising as part of your weight loss program. Basically, exercise is something that you *do* (a positive), whereas diet focuses on things you *won't do* (a negative).

Bottom line for weight loss: if you don't adhere to your program, you won't get the results you want. You can't be on a diet just between meals, and you can't be a fitness exerciser just between infrequent workouts. Period.

- **Frequency Recommendation**

Strength training frequency need not be more than two times per week, with at least 48 hours rest between sessions which involve the same muscle groups. In other words, if you choose to do full-body circuits, you should do them twice a week, but not on consecutive days.

But some fitness exercisers prefer to strength train more often than twice a week, and some may choose to divide their week into sessions devoted to different muscle groups on different days.

A typical every-other day schedule might be full-body circuits on Monday, Wednesday, and Friday, with Tuesday, Thursday, Saturday, and Sunday free.

Those who prefer a "split" program, with different days for different muscle groups, might use a schedule of upper body (chest, back, shoulders, arms) on Monday and Thursday, and lower body (legs, low-back, abdominals) on Tuesday and Friday. With this schedule, Wednesday, Saturday, and Sunday are free days.

"Free days" are an excellent opportunity for cross-training with cardio and flexibility sessions.

By the way, the rationale for the way split programs are designed is not just about resting the same muscles between workouts. It is also about resting the *tendons and ligaments at the joints*. For instance, a bench press (chest) and overhead press (shoulders) both involve *pushing* at the same joints (elbows and shoulders). So, while you can exercise the chest and shoulders on the same day, you should not exercise one and then the other on consecutive days.

Program design is how personal trainers combine art with science to develop the most effective and safe exercise programs for their clients. If you are not working with a trainer, just stick with the full-body circuits or splits discussed above.

▪ Intensity

Intensity refers to *how hard* you are working. There are two main methods for measuring intensity: percentage of your one-repetition maximum (1RM), and your self-described rating of perceived exertion (RPE).

1 Repetition Maximum (1RM)

Your 1RM represents the maximum amount of resistance that you can lift for one single repetition one time, but not more, using correct form and tempo. Obviously, larger muscles, such as your leg muscles, are stronger than smaller muscles, such as your biceps. So it follows that your 1RM for a leg press will be greater than your 1RM for a biceps curl.

But it is neither practical nor safe to test your strength to see how much weight you can maximally lift. And it's not necessary. Instead, use a resistance that poses a real challenge, but that you can correctly lift *more than once, but less than 16 times*. Again, using correct form and tempo, count the number of repetitions that you can perform with the submaximal resistance, and use the following chart to determine your equivalent 1RM.

Between the two methods, 1RM is more precise than RPE, but is really more appropriate for committed recreational exercisers. Fitness exercisers will do just fine using the simpler RPE method, so long as they are honest with themselves about how they self-describe their efforts.

Number of reps	% of 1RM
1	100
2	95
3	93
4	90
5	87
6	85
7	83
8	80
9	77
10	75
11	70

12	67
15	65

To learn how much resistance you should be able to lift one time (1RM) using this chart, simply divide the weight you lifted by the corresponding percentage of the 1RM on the chart, placing a decimal before the % of 1RM number. Example, if you lifted 60 lbs 7 times (7=83%):

$$60 \div .83 = 72 \text{ lbs.}$$

This means that you should be able to lift 72 pounds one time, but not more.

So, how much should you be lifting? ("Lifting" is a generic term for resistance exercises, regardless of equipment type.) 70 to 80% of your 1RM is a very good, productive range; more risks injury and less will not elicit a significant stimulus. Using this model, your 72-pound 1RM means that you should be lifting between 50 and 58 lbs (or the closest resistance available; there are no 58 lb weights or resistance settings).

Ratings of Perceived Exertion (RPE)

Don't want to do the 1RM math? Then RPE is for you. It is also perfect for all fitness exercisers when the goal is to preserve and maintain current muscle mass, or to restore muscle mass lost to a sedentary lifestyle.

RPE is a subjective method of self-describing your intensity level by assigning a numerical value to your effort from a pre-set scale. Each number corresponds to a description of the effort, such as "easy," "somewhat hard," "hard," "very hard," and so forth.

There are two main RPE scales. The original version rates exertion on a scale of 6-20. The revised version uses a 0-10 scale.

I have created my own version, the Modified RPE, which I believe resolves some of the incongruities of the other versions. You will find my Modified RPE at the conclusion of this article.

Pages 2 and 3 explain the rationale for each of the eight levels of the scale.

For additional information about exercise intensity, see my earlier article *Exercise: Measuring Intensity* under the *Exercise* heading in the blog section of the www.BarryTheTrainer.com website. In addition to a general discussion about measuring exercise intensity, you will find an additional link which opens a chart that compares the 6-20, 0-10, and my Modified RPE scales. If you like the RPE approach, which I suspect you will, use whichever version makes the most sense to you.

Regardless of which method you choose – 1RM or RPE – the idea is not to be exercising at those kinds of red-faced, vein-popping, loud-grunting intensities that are too often depicted as the *agony of exercise*. Instead, once you have moved passed the initial conditioning phase, you will settle into an intensity which remains the same, even as you increase intensity. This is because as you become stronger your newly increased resistance will remain at the same RPE or 1RM effort.

Repetitions and Resistance

Now that you've decided which intensity system to use, the next question is how many reps should you perform? That depends on several factors. Someone participating in a strength training program will initially be classed in one of three categories: *untrained*, *detrained*, or *trained*. The categories are important because two things must occur before engaging in a challenging exercise routine.

Untrained

The first thing to occur in an untrained strength trainer is called *motor unit learning*. This is when muscles learn how to perform an activity. It is much the same as learning to ride a bike. You start with training wheels, then with your dad running behind you, holding the seat and steadying your fledgling ride without the training wheels. Just because you've taken off the training wheels doesn't mean you're ready to compete in the Tour de France, and winning the TDF doesn't mean you're ready to be a New York City bicycle messenger.

Back to reality. Someone new to strength training will see rapid early gains in how much they can lift. But these early gains are not so much strength gains as they are your muscles learning

how to perform the exercises against resistance; it's taking off the training wheels.

Second, strength training does not just involve your muscles. Important adaptations also occur with the *connective tissue*, which are the ligaments and tendons associated with the muscles being exercised. As you begin training your muscles, your connective tissue becomes thicker and stronger, allowing the muscles to work against higher resistance with less risk of injury. Use-injuries (not muscle soreness) that occur during exercise are usually thought of as muscle injuries. But, more often, the actual trauma has occurred at the connective tissue and the usual cause is placing a greater load demand on the tissue than it can safely withstand.

A new-to-lifting strength exerciser should begin with a program of *low resistance* and *higher reps* – 15 reps is a good number – for the first six weeks. Thereafter, *gradually increase* resistance while decreasing repetitions.

If you are using my Modified RPE method, level 4 is an appropriate beginning work range, progressing over time through level 5, to level 6.

- **Level 4 “Somewhat Hard”** means *I can complete the task with some effort, but could still do more*
- **Level 5 “Hard”** means *I am struggling to complete the task; could maybe do 1 or 2 more*
- **Level 6 “Very Hard”** means *I can complete the task, but not more.*

Detrained

A detrained (aka “deconditioned”) participant is someone who used to be a well-conditioned strength trainer who, for whatever reason, has stopped training long enough to lose all or most of their conditioning. However, a detrained exerciser will revert back to a conditioned state much faster than an untrained person will attain that same level of conditioning. The detrained exerciser should ease back into training, but can expect to be back in form relatively soon.

By the way, conditioning is lost on an approximate ratio of 1.5:1, meaning it takes about 9 months to lose 6 months worth of training, though the loss of conditioning will begin the downward slide soon after training has been stopped. This is why it is necessary to somewhat dial back your intensity when returning to strength training after taking time off.

Trained

A trained participant – someone who has been strength-training for a year – will get best results from lifting in the range of 8-12 repetitions to failure; failure meaning not being able to complete one more repetition while maintaining proper form and tempo. This corresponds to level 5 (hard) and 6 (very hard) on my Modified RPE scale.

Progression

Progression is the key to continuing success with your fitness strength training program. Think of progression *ion* as progressing *ing*; as in *progress*.

A training stimulus occurs when muscles are subjected to a workload which is greater than they are accustomed to; it's called *overload*. Getting stronger means that your muscles have *adapted* to what used to be an overload, and have become efficient at performing with that load. But muscles should not be exercised efficiently; they need to be exercised *inefficiently*. This means that once they become efficient at a given level of resistance, it's time to *increase intensity*.

Increasing Intensity

There are three ways to increase intensity: increase repetitions, increase sets, increase resistance.

Recall that throughout I have made reference to repetition ranges, such as 8-12. This means that if you are performing, say, biceps curls, within an 8-12 rep range, you will initially start with a resistance that you can lift 8 times, but not more, using proper form and tempo. Over time, as you become stronger, you will be able to lift that resistance more than 8 times. You will stay with the same resistance, performing as many repetitions as you can, until you can perform more than 12 repetitions.

Once you can perform *more* than 12 reps, it is time to increase the resistance. The new resistance should take you back to the maximum resistance that you can lift 8 times, but not more, and the process begins anew, at the increased resistance.

The most effective progression scheme calls for increasing repetitions before increasing sets, and increasing sets before increasing resistance.

Reality check: There comes an end-point beyond which you will not continue gaining strength within a fitness strength training continuum. This is when you have reached the maintenance stage of your strength training program. Cross-training and trying different exercises now become important for keeping your workouts fresh and interesting.

Notable Exceptions

The American College of Sports Medicine, which is the defining authority for those of us in the fitness business, recommends the following repetition ranges for other populations:

- Older adults and frail persons (age 50-60): 10-15
- Those interested in muscular endurance more than strength: 10-15
- Cardiac patients - *with physician approval*: 10-12 (comfortably)

Pregnant women, pre-pubescent children, and others with health or medical conditions can usually participate in strength training, but should follow guidelines from their healthcare professionals.

▪ **Time**

There are two components for measuring exercise time (both cardio and strength training): the amount of time actually spent exercising, and the total amount of time from start to finish, including warm-up, cool-down, and stretching.

Exercise Time

A good workout can be accomplished in as little as 20 minutes. This assumes that you are performing one complete circuit of 10 exercises – one each for your quadriceps, hamstrings, calves, back, shoulders, biceps, triceps, low-back, and abdominals. It also assumes that you have pre-planned your session so that you can move from one exercise to the next with minimal rest (not more than 60 seconds) in between. It also assumes that you will be performing 8 reps of each exercise, using 5 seconds (2 seconds *up*, 1 second *"squeeze,"* 2 seconds *return*) per repetition. This is the minimum that would constitute a full-body workout.

Performing more than 8 reps will take longer than 20 minutes, as will performing more than one set of the same exercises or resting more than 60 seconds between exercises. As mentioned earlier, studies have concluded that exercisers will gain about 80% of the benefits from a single-set routine as will be received from a multi-set program.

Personally, I like a 2-set program for fitness strength training. With a 2-set program, I recommend performing the first set at a lesser intensity, such as level 4 (somewhat hard) on my Modified RPE scale. This will not only deliver a reasonable dose of exercise benefit, but will make it easier to perform the second set at a higher intensity. This is because by the time you begin the second set, you will have just worked your muscles and connective tissue through a full range of motion under resistance. Think of it as an extension of the warm-up, but counted as part of your exercise time. The second set should then be performed at a level 5 (hard) or level 6 (very hard).

Total Time

Total time is the amount of time out of your day that is specific to exercise. This includes not just the exercise session itself, but the warm-up, cool-down, and stretching activities as well. So while these activities are not counted when determining your exercise time, they are part of the exercise commitment.

Form and Tempo

Proper form and tempo are always critical elements when performing strength training exercises. Improper form and tempo are two of the main mistakes that people make.

Form

Proper form is about two things: correct spinal alignment and performing each exercise in the manner in which it is intended to be performed. Improper spinal alignment can easily lead to injury, especially when an exercise is performed with bad form. These kinds of injuries can happen all at once, or after a number of workouts where the same bad form is always the same. An example would be pulling the bar behind your neck while performing a lat pull-down exercise. This can easily lead to shoulder impingement syndrome, and eventually to a damaged rotator cuff. Yet, trainers see people making this mistake all the time.

Another aspect of bad form is "cheating." Cheating is when you allow momentum to assist in the exercise, such as bouncing the bar off your chest during a bench press, or swinging your arms during a curling movement. Each exercise movement should be performed in a slow and deliberate manner throughout the entire range of motion for that exercise.

And still another form of cheating would be arching your back so as to involve strength and/or leverage from muscles not specifically targeted for the exercise being performed. This mistake is typically seen in exercises like the bench press and various seated exercises, such as an overhead press. The rule is simple: *If the resistance is too great to lift using proper form, you are using too much resistance*; reduce the resistance to an intensity that you can execute at least the minimum number of times called for within your rep range.

Tempo

Tempo is the speed of movement during each phase of a repetition. Obviously, it is not easy to *lift* against a challenging resistance using a fast speed. But just as obviously, it would be quite easy to return to the starting position during the *lowering* phase of the repetition simply by not resisting the downward pull of gravity. But, this would be a mistake.

Each exercise repetition has three distinct phases: The *concentric*, or “lifting” phase, when force is applied against resistance, such as at the start of the repetition; a brief “*squeeze*” of the muscle involved at the top of the concentric phase; and the *eccentric*, or “lowering” phase, which is when force is applied against gravity, such as at the end of the repetition. It may surprise you to learn that more strength is gained from the eccentric phase of a repetition than during the concentric phase. This is why it is crucial to lower the resistance in a controlled fashion, taking as much time, or *more time*, than during the lift.

There are various tempo schemes employed by trainers, but they all are similar. The one I like is 2 seconds *up*, 1 second *squeeze*, and 2 seconds *down*. Not only is 2-1-2 an effective tempo, it is also *realistic* in that unless you are working-out with a metronome or a training partner who is calling cadence, *up-up-squeeze-down-down*, it is near impossible keeping track of your repetitions while timing yourself using an unequal tempo, like 2-1-3, at the same time. With 2-1-2, all you have to get used to is the “2,” because it’s the same on both ends, and the 1 second squeeze is just a matter of doing it – you don’t really have to time it. And finally, if the 2-count actually takes you slightly longer or slightly less than two seconds, it’s not a hanging offense. The important thing is to work at a controlled, unhurried tempo, both up and down, with a brief squeeze in between.

Opposing Pairs

Because when you look in the mirror you just see yourself from a frontal view, you tend not to pay much attention to anything on the other side; out of sight, out of mind.

But muscles are arranged in opposing pairs, with one-half of most pairs on your back side. So, while it's easy to see your chest or quadriceps or abdominals in the mirror, it's just as easy to forget about your back and hamstrings. Because muscles you don't see in the mirror are part of a matched pair, ignoring them during exercise will result in a muscle imbalance.

Think of a muscular imbalance as a business partnership. Two guys are best friends in school, enjoying the same sports, dating girls from the same social circle, and enjoying many of the same things. When they graduate, they form a partnership and open a business together. Over time, it turns out that one of the partners becomes lazy and doesn't contribute as much as the other partner, who now has to do more than intended, while the other does less, and the business suffers as a result.

This discussion is only about problems directly related to muscle and/or connective tissue imbalances. It is not intended as a commentary about skeletal abnormalities or injuries, which are entirely the domain of medical professionals.

Muscular imbalance is like a bad partnership. It has the potential for creating postural deviations and alignment issues which range from purely aesthetic to painful. Low-back pain, for example, is often associated with weakness in the abdominal muscles.

Rounded shoulders, lordosis, flat-back, sway-back, kyphosis, and forward-head are examples of postural deviations that are often associated with tight muscles opposing weak muscles.

To avoid the kinds of muscle imbalances that are caused by localized muscle weakness, be sure to exercise *all* of the major muscle groups – not just the ones you see in the mirror.

Also remember to regularly perform stretching and flexibility exercises to keep your muscles, tendons and ligaments from becoming tight. Tightness, in addition to being uncomfortable, can restrict your range of motion, as well as manifest into postural irregularities.

Warm-up and Cool-down

I cannot overstate the importance of performing proper warm-up and cool-down activities. And yet, far too often you see people in the gym simply performing a few mock stretches lasting less than a minute and calling that their warm-up, and giving no thought whatsoever to a cool-down when they're finished.

Warm-up

An effective warm-up prepares the exerciser - both physically and mentally - for the exercises which follow. Always begin your warm-up with a simple 5 minute light cardio activity. If you're in the gym, use any of the cardio equipment (treadmill, elliptical trainer, rowing machine, stationary bike). This is not intended as an exercise, so go slow, using *low* intensity, rhythmic movements. If you are working-out at home and you don't have any cardio equipment, a 5 minute walk around the block, or marching in-place for 5 minutes, works just as well.

The purpose of the warm-up is to gradually *raise the temperature of your muscles and connective tissue*, making them more supple and pliable. As this happens you will also be raising your heart rate above your normal heart rate, which, as a result, delivers more oxygen- and nutrient-rich blood flow to your muscles.

Follow the light cardio warm-up with a brief series of stretches involving the muscles to be exercised. Hold each stretch for 20-30 seconds, and always include your back muscles.

Cool-down

The cool-down is similar to the warm-up phase in that it is performed the same way - slow, rhythmic movement of the large muscle groups.

As important as the warm-up is, the cool-down is even more so.

The cool-down redistributes post-exercise blood pooling from the lower body. It also prevents a too sudden drop in blood pressure, which could otherwise lead to lightheadedness and even fainting.

Other important reasons for an adequate cool-down are to prevent or reduce muscle cramping and spasms, and reducing the risk of post-exercise disturbances in cardiac rhythm.

Calories Burned During Strength Training

As mentioned earlier, the realization that strength training is a crucial component of overall physical fitness, applicable to people of all ages and both genders, is a recent event. Earlier, when strength training was still in the Dark Ages of fitness, it was considered only to be for younger men, and it was all about packing on muscle for either athletic performance, or just muscle for the sake of muscle for the sake of narcissism. Women didn't strength train at all, and neither did seniors. It was a widely held belief that if you lifted weights, you would become muscle-bound and not be able to move well; and that if you ever quit lifting all of that muscle would surely turn to fat. Now, we know that none of those things are true.

We've also learned that strength training can play a major role in fat loss. While exactly how many calories burned during strength training is dependent on many factors, such as workout duration and intensity, age, gender, physical condition, and body-weight, what we do know is that each one hour workout burns from 200 to more than 500 calories by itself.

But the exciting news is that following a strength training session you will *continue to burn calories at an accelerated rate, long after the workout has finished*. This after-burn is known as "excess post-exercise oxygen consumption," or EPOC.

Following an intense workout, the after-burn can last for many hours, keeping your metabolism revved up and burning many more calories than if you had not worked out at all. One study that I read about reported a 13% increase over pre-exercise resting metabolic rate three hours post-exercise, and a 4.2% increase in RMR *16 hours later*. Imagine, not only did the test subjects expend a lot of calories during their workout, but were continuing to do so at a higher rate than before the workout 16 hours later! Even following a moderately intense session lasting less than an hour there will be a reasonable EPOC effect.

The chart you will find at the end of this article gives the approximate number of calories burned during weight training based on both Moderate and Intense workloads, body-weights ranging from 175-250 pounds, and durations lasting 20, 40, and 60 minutes. The data I used has been extrapolated from the American Council on Exercise's physical activity calculator.

Exercise Recommendation

Working With a Trainer

Working with a certified personal trainer has many advantages. It is always the easiest and fastest way for making sure that your exercise program is safe and addresses your personal fitness goals in the most effective and time-efficient manner.

Personal trainers can work with you on all aspects of physical fitness, from strength gains and maintenance, to muscle tone and restoration of lost muscle mass. Also, cardiovascular endurance, and weight management as enhanced through exercise are within the core competencies of personal trainers.

You can expect your trainer to design a program which not only addresses your goals, but that will properly respond to plateaus, which is when your progress stalls, so that you will keep moving forward. Such responses can range from minor tweaks to a major program overhaul; to knowing when to dial-down exercise intensity to taking some time off; it's where art meets science.

And with respect to safety, not only will your trainer design a program with quality exercises and properly coach you on how to do them, you can expect your trainer to pre-screen you for potential risks against known risk factors that, when present, require a physician's clearance before proceeding.

All health clubs have personal trainers available to help you. Also, virtually all clubs only hire trainers who have been certified by one of the major fitness organizations, such as the American Council on Exercise (ACE).

Personal trainers are also available to work with you in your home, or other venues outside of a health club setting. You can expect that your trainer will be familiar with all types of home exercise equipment, and can design a good program around what you already have. And if you don't have any personal exercise equipment, your trainer will bring what's need with him or her.

Many personal trainers specialize in in-home training. Just be sure to ask about his or her certification, and also about their liability insurance.

Finally, personal trainers – in-home or club – are available in various ways, from a simple consultation and fitness assessment, through single-sessions, to multi-session, and outcome-based package programs.

Self-directed Exercise Program

Many people, especially those with no special needs other than honing and maintaining their physical fitness, workout on their own.

Recommendation

The chart which follows, *Exercise by Muscle Group*, lists a selection of exercises for each muscle group, either as a (✓) targeted muscle or a (●) synergist muscle. Synergist muscles assist the functioning of other muscles, including during exercise. An example would be the forearms which act synergistically with the biceps. You cannot perform a biceps curl without engaging the forearms. However, the main benefit of the biceps curl will be to the biceps, with a lesser, secondary benefit to the forearms. For this reason, exercises should be selected based on target muscle groups.

Also, each exercise is identified as being either a (c) compound or (i) isolation exercise. Compound exercises involve movement at *more than one joint*, and all or some of the muscles associated with those joints. Isolation exercises involve just *one joint*, and the muscle(s) associated with it.

Compound exercises are preferred over isolation exercises due their multi-muscle involvement, which gives you a bigger bang for the buck exercise-value wise, as well as being more time efficient. Isolation exercises are especially useful when there is a need to address a specific muscular weakness or imbalance.

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Calories Burned During Weight Training

Body Weight	Minutes	Moderate			Intense		
		8 Reps per Set	10 Reps per Set	12 Reps per Set	8 Reps per Set	10 Reps per Set	12 Reps per Set
		10 Exercises 60 Seconds Rest Between Sets			10 Exercises 60 Seconds Rest Between Sets		
175	20	79			159		
175	40		159			318	
175	60			238			476
180	20	82			163		
180	40		163			327	
180	60			245			490
185	20	84			168		
185	40		168			336	
185	60			252			503
190	20	86			172		
190	40		172			345	
190	60			259			517
195	20	88			177		
195	40		177			354	
195	60			265			531
200	20	91			181		
200	40		181			363	
200	60			272			544
205	20	93			186		
205	40		186			372	
205	60			279			558
210	20	95			191		
210	40		191			381	
210	60			286			572
215	20	98			195		
215	40		195			390	
215	60			293			585
220	20	100			200		
220	40		200			399	
220	60			299			599
225	20	102			204		
225	40		204			408	
225	60			306			612
230	20	104			209		
230	40		209			417	
230	60			313			626
235	20	107			213		
235	40		213			426	
235	60			320			640
240	20	109			218		
240	40		218			435	
240	60			327			653
245	20	111			222		
245	40		222			445	
245	60			333			667
250	20	113			227		
250	40		227			454	
250	60			340			680

Rep Speed

2 seconds *up*

1 second *squeeze*

2 seconds *down*

5 seconds *total* repetition speed

Using faster or slower rep speeds will distort caloric expenditure values as expressed.

Rest Between Sets

More than 60 seconds rest between sets diminishes the number of calories burned.

Actual Times

Actual times based on the above values are:

8 reps x 10 exercises = 17 minutes (20 min used)

10 reps x 10 exercises = 37 minutes (40 min used)

12 reps x 10 exercises = 60 minutes

20 (17) minutes = 1 circuit of 10 exercises

40 (37) minutes = 2 circuits of 10 exercises

60 (60) minutes = 3 circuits of 10 exercises

Intensity

Based on Barry Bassin's Modified Ratings of Perceived Exertion, the following RPEs apply:

Normal = 5 (Hard)

Intense = 6 (Very Hard)

Accuracy

Calories burned as presented are approximate values only. Actual expenditures are subject to variables. The values expressed herein should be used as a guide only.

Erratum

20-minute and 40-minute calculations are used for 17-minute and 37-minute calculations, respectively, based on available data. These calculations are close enough to 17-minute and 37-minute actual program times to be useful for calculating caloric expenditures.

Data Source

American Council on Exercise (ACE) physical activity calculator.

- ✓ = **Targeted** muscle; receives **direct benefit** from the indicated exercises.
 - = **Synergist** muscle; **assists** the target muscle during the indicated exercises.
- (c) = **Compound exercise**.
- (i) = **Isolation exercise**

Compound (c) exercises involve movement at **more than one joint**, and all or some of the muscles associated with those joints.

Isolation (i) exercises involve movement at a **single joint** and the muscle(s) associated with that joint.

Compound exercises are preferred for general fitness (vs. isolation exercises) due to their multi-muscle involvement.

Isolation exercises are best used when dealing with a weak muscle(s), resulting in an **imbalance** with an **opposing muscle(s)**.

Muscular imbalance: Muscles are arranged in opposing pairs, such as back and chest, biceps and triceps, quadriceps and hamstrings, and low-back and abdominals. An imbalance occurs when one muscle(s) is stronger or weaker than its opposing muscle(s). Example: low-back pain is often associated with weak abdominals.

Only the most **directly involved muscles** are indicated for exercises listed on this chart.

There are **variations to many exercises**. Each variation may have a similar or different name.

Major muscle groups may be **exercised directly**.

Some muscles (e.g., glutes) can only be exercised in **conjunction with other muscles** (i.e., upper legs and hips).

Many exercises can be performed with a **variety of different equipment** (tubes/bands, cables, free-weights, machines, body-weight), and some may not.

Use this chart only as a guide. Many exercises can be performed in **varying positions** (i.e., *flat* bench press, *incline* bench press, *decline* bench press, etc.). Each variation may alter specific muscle involvement (i.e., *upper* pecs, *general* pecs, *lower* pecs), though the **main target muscle remains the same**.

Depending on the level of conditioning of the exerciser and the intensity of the exercise session, **workouts should not last longer than 45-60 minutes**. Longer sessions may have several **unfavorable consequences**, such as **muscle loss** (catabolic effect), overuse injuries, and burnout, especially when long sessions are frequently repeated.

Muscle is stimulated during exercise, but **grows and becomes stronger during rest**.

To ensure proper rest, **do not exercise the same muscles on two consecutive days**, and always get at least **7 hours of sleep**.

Circuit Training

A circuit is performing one complete set of each exercise.

A circuit-training workout may consist of one single circuit, or multiple circuits.

Because one complete circuit takes about 20 minutes, three circuits (60 minutes) is the maximum number of circuits to use.

Go from one exercise directly to the next with **minimal rest** (< 60 seconds) between sets

Chose **one** exercise for **each** muscle group.

Chose exercises based on **Target (✓)** muscles. **Synergist (○)** muscles have secondary, lesser involvement.

Perform exercises to coincide with the order listed - i.e., quadriceps, hamstrings, calves, etc.

Modified Ratings of Perceived Exertion (RPE)

1 NOTHING
Nothing at all; no sense of exertion or challenge

2 MINIMAL
I barely feel it; I will get bored before I get tired

3 EASY
I feel it but it's not hard; I could do a *lot* more

4 SOMEWHAT HARD
I can complete the task with some effort; but I could still do more

5 HARD
I am struggling to complete the task; could *maybe* do 1 or 2 more

6 VERY HARD
I can complete the task, but not more

7 TOO HARD
I can do some but not all of the task

8 IMPOSSIBLE
I cannot do this

1 NOTHING

Examples

- Mimicking a biceps curl without actually holding a weight, or holding a weight that poses no challenge whatsoever.
- A casual stroll.

Breathing: normal, easy.

2 MINIMAL

Examples

- Performing a biceps curl with a weight that is substantially lighter than what you can lift to affect a challenge.
- Normal, unhurried walking

Breathing: normal, easy.

3 EASY

Examples

- Similar to MINIMAL, but not *that* easy.
- Walking at a determined pace (not late for the bus, but don't want to miss it).

Breathing: normal or near-normal.

4 SOMEWHAT HARD

Examples

- Completing 13 reps of a 10-rep set; time to progress to a greater load (5-10% more).
- Jog-walk-jog; fast walking; equivalent bike or machine intensity

Breathing: slightly increased; quick recovery.

5 HARD

Examples

- Completing 10 reps of a 10-rep set, maybe eeking out 1 or 2 more reps; a good working range and ready or almost ready to progress to a greater load.
- Steady-state jogging; fartleks/intervals; equivalent bike or machine intensity

Breathing: labored breathing but not panting.

6 Very Hard

Examples

- Can complete 10 reps of a 10-rep set, but not more; a good working range
- Faster jogging; hill running; HIIT; equivalent bike or machine intensity

Breathing: labored breathing, slightly panting.

7 TOO HARD

Examples

- Can complete 7 reps of a 10-rep set; depending on the goal (fitness, hypertrophy, etc.), stay at present load and wait for adaptation for more reps, or reduce load to complete 10 reps per set.
- Sprinting; running stadium-steps; HIIT - all beyond long-duration sustainable levels; ditto equipment cardio

Breathing: panting by the end; rapid heart-rate.

8 IMPOSSIBLE

- An inappropriate task; reduce workload to an appropriate intensity.
- High-risk; may cause Valsalva maneuver; may cause musculoskeletal injury

Notes:

- (1) Applies equally to all forms of exercise (strength and cardio);
- (2) 10-rep set is used as an example only; program design may call for a higher or lower rep range.
- (3) Breathing also corresponds to heart-rate response.