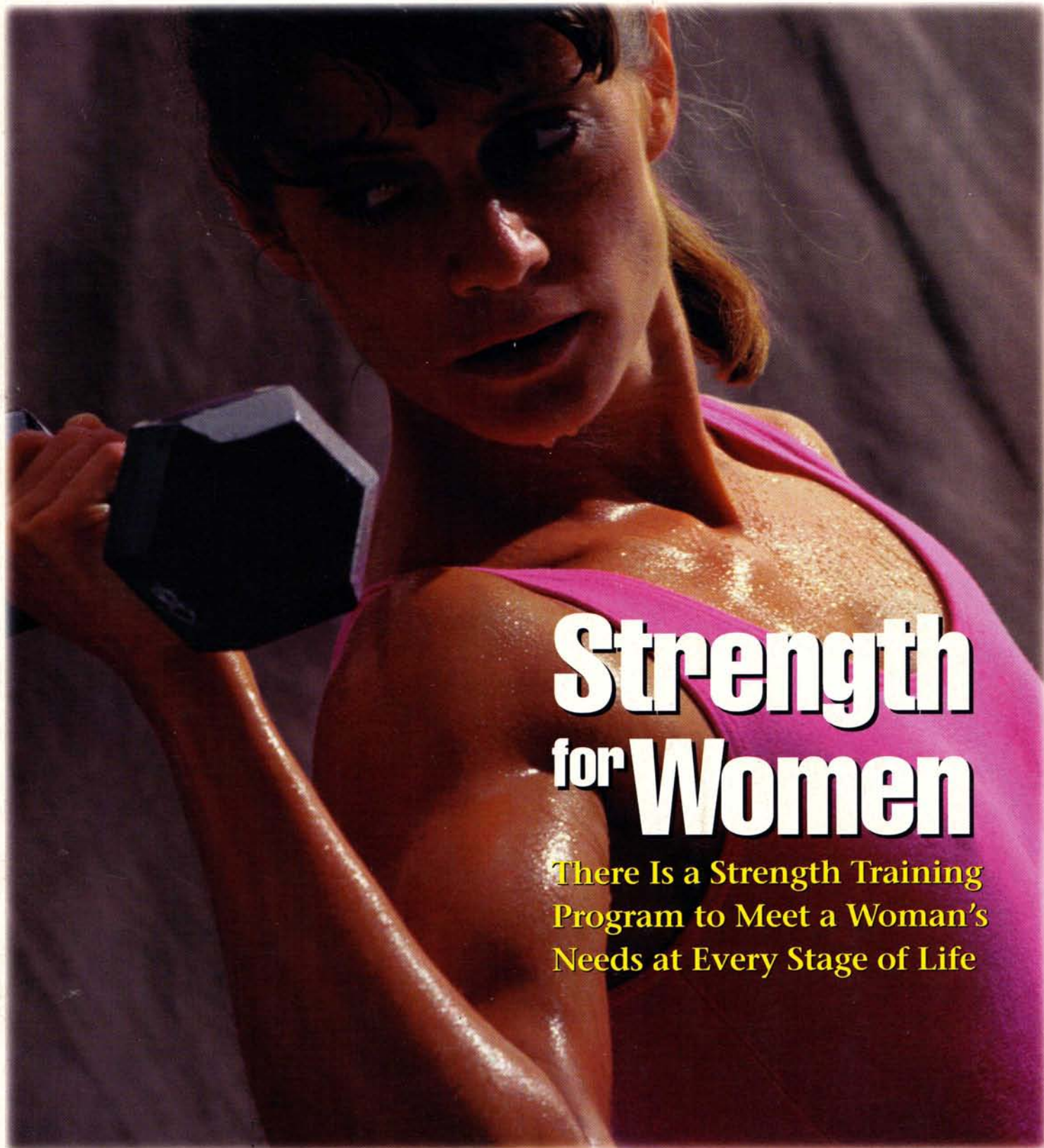


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JUNE 1998



## Strength for Women

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# Quality REPS

The REPS prescription will help your clients remember the basics of strength training movements for greater effectiveness and safety.

By Matt Brzycki

**R**EGARDLESS OF THE type of strength-training program, a quality program begins with quality repetitions. Indeed, the repetition is the most basic and integral aspect of any strength-training program.

A repetition has four main components: the concentric phase (when a muscle shortens against a load, such as when you raise a weight), the middle or "mid-range" position, the eccentric phase (when a muscle lengthens against a load, such as when you lower a weight), and range of motion. The following is a detailed prescription for performing quality REPS.

## **R** — Refrain...

*Refrain from using momentum during the concentric phase.* A repetition starts with the concentric phase — that is, the raising of the weight. The concentric phase of a quality repetition is done by raising the weight in a deliberate, controlled manner without any jerking movements.<sup>1,2,3,4</sup>

Performing repetitions in a rapid, explosive fashion is ill-

**A brief pause makes a smooth transition between the concentric and eccentric phases of the repetition and helps eliminate a momentum effect.**

advised for a few reasons. First, high-velocity repetitions that are performed in a ballistic manner are actually less productive and less efficient than low-velocity repetitions that are performed in a controlled manner.<sup>1,2,3,6,10,12</sup> Here's why: Whenever repetitions are performed explosively, momentum provides the movement. After the initial explosive movement, little or no tension is generated by the muscles through the remaining range of motion. In simple terms, the weight is practically moving by itself.

To illustrate the effects of momentum on muscular tension, imagine that you pushed a 100-pound cart across the length of a basketball court at a deliberate, steady pace. In this instance, you applied a constant load on your muscles for the

entire distance. Now, suppose that you were to push the cart across the court again. This time, however, you accelerated your pace to the point where you were running as fast as possible. If you were to stop pushing the cart at mid-court, it would continue to move by itself because you gave it momentum. So, in this case, your muscles had resistance while moving over the first half of the court, but not over the last half of the court. The same effect occurs in the weight room. When weights are lifted explosively, your muscles are "loaded" during the initial part of the movement, but not during the last part. In effect, the requirement for muscular tension is reduced, and so are the potential strength gains.

Unfortunately, the reduced muscular loading that is related to the use of momentum is demonstrated in weight rooms on a daily basis. For example, have you ever raised a weight so quickly on a leg extension machine that the pad left your lower legs halfway through the repetition? Well, the pad is attached to the movement arm of the machine which, in turn, is connected to the resistance by some means — such as a chain, cable or strap. If the pad is no longer in contact with your lower legs, there's no load on your muscles. If there's no load on your muscles, your muscles have no stimulus, or reason, to adapt. In this example, the only load on your muscles is from the weight of your lower legs. There's no question that the involvement of momentum makes repetitions less efficient.

Explosive lifting can also be dangerous.<sup>1,2,3</sup> If explosive lifting doesn't cause immediate musculoskeletal damage, it will certainly predispose you to future injury. Dr. Fred Allman, a past president of the American College of Sports Medicine, states, "It is even possible that many injuries ... may be the result of weakened connective tissue caused by explosive training in the weight room."<sup>5</sup>

Using momentum to raise a weight increases the internal forces encountered by a given joint; the faster a weight is raised, the greater these forces are amplified, especially at the point of explosion. In one study, a subject squatting with 80 percent of his four-repetition maximum incurred a 225-pound peak shearing force during a repetition that took 4.5 seconds to complete and a 270-pound peak shearing force during a repetition that took 2.1 seconds to complete. This is clear evidence that a slower repetition speed reduces the shearing forces on joints.<sup>6</sup> When the forces exceed the

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structural limits of a joint, an injury occurs in the muscles, bones or connective tissue. Raising a weight in about one to two seconds will guarantee that you're exercising in a safe, efficient manner.<sup>1,3</sup>

### **E** — Emphasize...

**Emphasize the mid-range position.** After raising the weight, you should pause briefly in the position of full muscle contraction or the "mid-range" position.<sup>1,2,4</sup> For example, when performing a leg extension, the mid-range position is where your legs are fully extended (or as straight as possible); when performing a bicep curl, the mid-range position is where your arms are fully flexed (or as bent as possible). [Ed. note: Visualize the bicep curl on a machine, not with a free weight that allows the muscle to relax when the weight is directly above the elbow.]

Most people are very weak in the mid-range position of a repetition because they rarely, if ever, emphasize that position. Pausing momentarily in the mid-range position allows you to focus attention on your muscles when they are fully contracted. Further, a brief pause permits a smooth transition between the concentric and eccentric phases of the repetition and helps eliminate the effects of momentum. If you can't pause momentarily in the mid-range position, it's likely that you are raising the weight too quickly and throwing it into position.

### **P** — Perform...

**Perform the eccentric phase in a deliberate fashion.** A repetition ends with the eccentric phase — that is, the lowering of the weight. The importance of involving the eccentric phase of repetitions cannot be overemphasized. Numerous studies have reported that exercise involving both concentric and eccentric muscle contractions produces greater increases in strength than exercises utilizing just concentric muscle contractions.<sup>7,8</sup> In addition, research has noted that optimal muscular hypertrophy is not attained from weight training unless eccentric muscle contractions are involved.<sup>9</sup>

**Research has noted that optimal muscular hypertrophy is not attained from weight training unless eccentric muscle contractions are involved.**

Your eccentric strength is greater than your concentric strength. From an application standpoint, this means that you can lower more weight than you can raise. In fact, research has shown that a fresh muscle can lower approximately 40 percent more than it can raise.<sup>4</sup> In other words, if the most weight you can raise is 100 pounds, you can prob-

ably lower about 140 pounds. Because your eccentric strength is greater than your concentric strength, it stands to reason that the eccentric phase of a repetition should be accentuated for a longer period than the concentric phase. It should take about three to four seconds to lower the weight back to the starting/stretched position.<sup>1,3</sup>

The lowering of the weight should also be emphasized because it makes the repetition more efficient — the same muscles that are used to raise the weight are also used to lower it. The only difference is that when you raise a weight, your muscles are shortening against a load, and when you lower a weight, the same muscles are lengthening against the load. So, by emphasizing the lowering of a weight, each repetition becomes more efficient and each set becomes more productive. Because a muscle lengthens as you lower the weight, a controlled speed of movement also ensures that the exercised muscle is being stretched properly and safely.

A quality repetition should last roughly four to six seconds. Most strength coaches who are opposed to explosive, ballistic movements in the weight room consider a four-to six-second repetition an acceptable guideline for lifting under "control" or "without momentum." A 16-week study demonstrated a 50-percent increase in upper-body strength and a 33-percent increase in lower-body strength in a group that performed each repetition by raising the weight in two seconds, and lowering it in four seconds.<sup>10</sup>

More recently, an eight-week study reported an average increase in muscular strength of 55 percent in 17 subjects, and another eight-week study showed an average increase in muscular strength of 58.2 percent in 31 subjects.<sup>11</sup> In both of these studies, the subjects used six-second repetitions (two seconds raising and four seconds lowering).

### **S** — Stimulate...

**Stimulate your muscles throughout the greatest range of motion.** A quality repetition is done throughout the greatest possible range of motion that safety allows — from a full stretch to a full muscular contraction, and back to a full stretch. Performing your repetitions throughout a full range of motion allows you to maintain (or perhaps increase) your flexibility.<sup>3</sup> Furthermore, it ensures that you are stimulating your entire muscle, not just a portion of it, thereby making the repetition more efficient and productive.<sup>1</sup> Indeed, research has shown that full-range exercise is necessary for a full-range effect.<sup>12</sup>

This does not imply that you should avoid limited-range exercise altogether. During rehabilitation, for example, you can do your repetitions throughout a pain-free range of motion and still manage to stimulate some gains in muscular

## R.E.P.S.

### Prescription for Quality Reps

- R** — Refrain from using momentum during the concentric phase.
- E** — Emphasize the mid-range position.
- P** — Perform the eccentric phase in a deliberate fashion.
- S** — Stimulate your muscles throughout the greatest range of motion.

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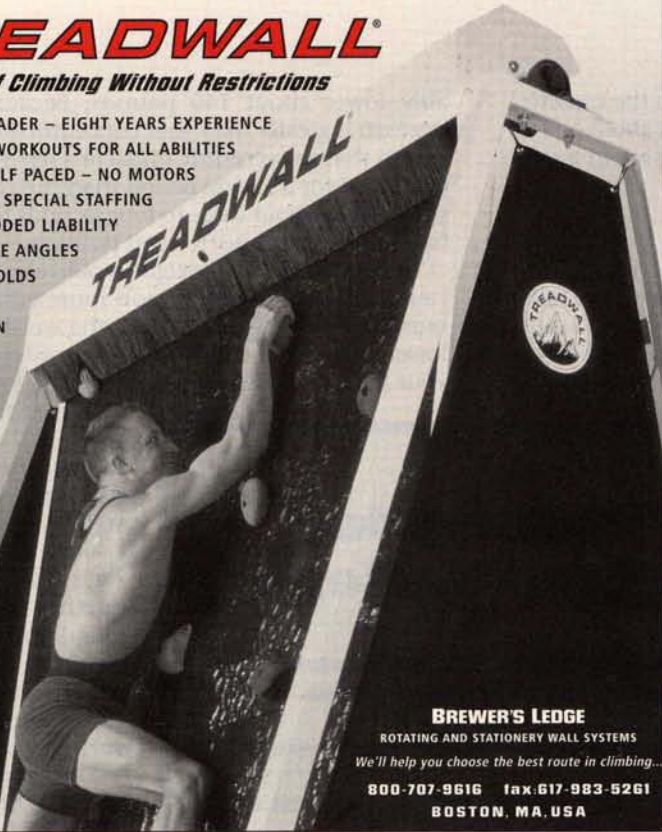
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## Quality REPS

strength. However, full-range repetitions are more productive and should be performed whenever possible.

### Quality not quantity

It's much safer and more efficient to raise the weight without any jerking or explosive movements, and to lower it under control. Raising the weight in about one to two seconds and lowering it in about three to four seconds ensures that the speed of movement is not ballistic in nature and that momentum does not play a significant role in the efficiency of the exercise.

Remember, *how* you lift a weight is more important than *how much* weight you lift. Your strength training programs will be much safer and more efficient by having clients perform quality REPS. **FM**

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