EXERCISE PROTOCOL

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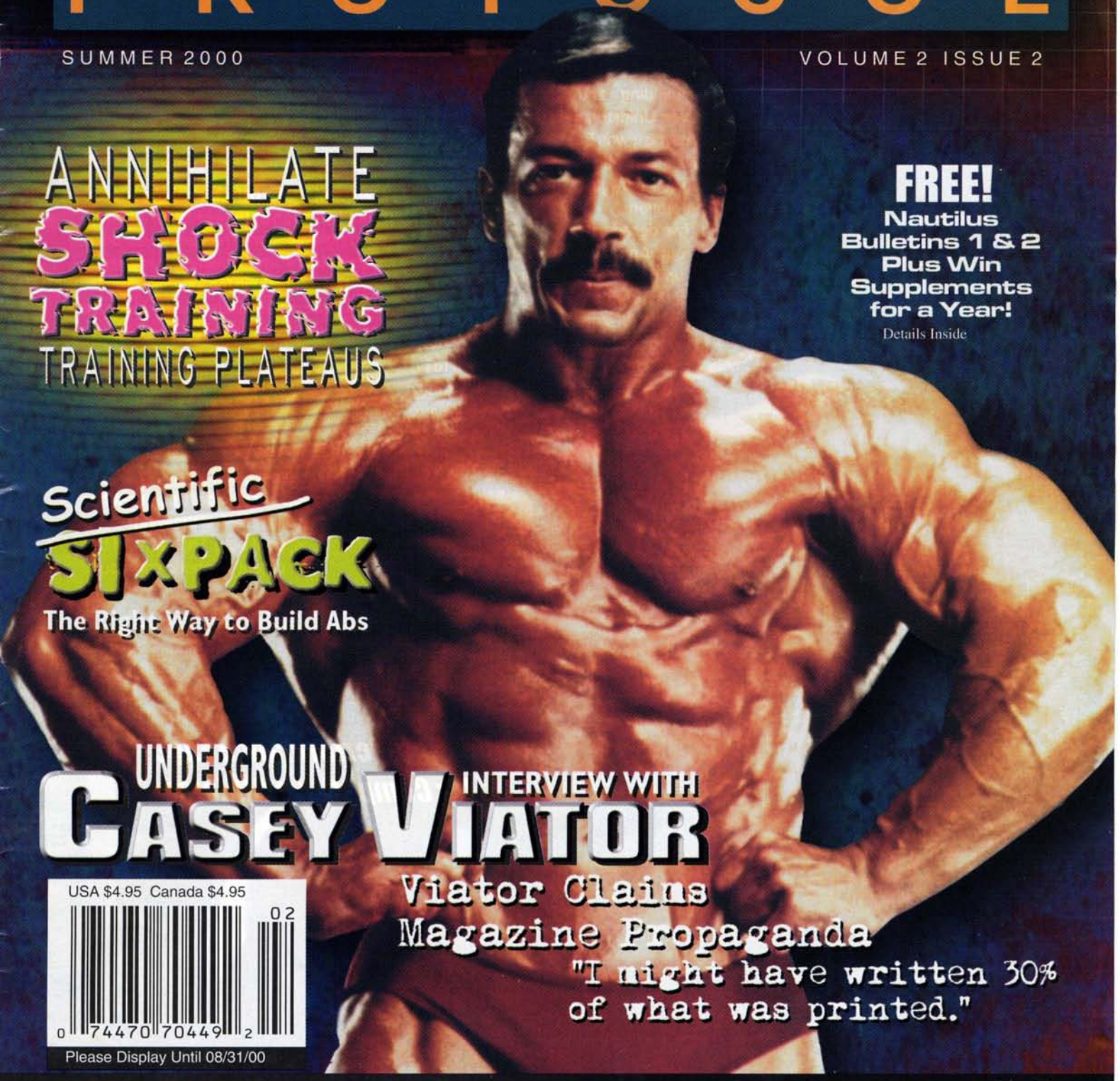

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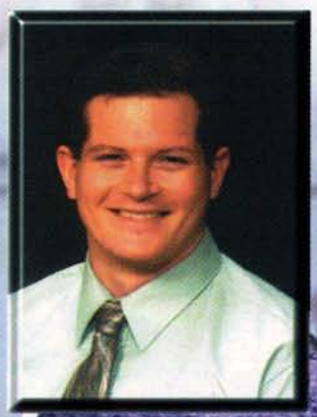
ROUND TABLE

How Extensive does a warm-up need to be prior to a resistance training session and how should it be applied?



Greg Bradley-Popovich MSEP, MS

I prefer simple warm-ups. I warm-up on a compound (i.e., multi-joint) exercise that I will be performing during that particular workout. I select a load that approximates 70% of the work load and perform a set of 10 controlled repetitions. I do not allow my warm-up to result in any perceptible fatigue such as muscle burning due to increased lactic acid production. I see additional warm-up sets for subsequent exercises on a split routine being redundant. For example, on "back" day, after warming up on lat pulldowns, I prepared my shoulder girdle and upper limb musculature. With whole-body routines, however, you should warm-up each *muscle group* (not each *exercise*).

The above may seem somewhat arbitrary, but there is little evidence evaluating the relationship of warm-ups to incidence of resistance training injuries. Moreover, it seems unlikely that a controlled moderate to high-rep set (6-12) would result in a high risk of injury since the loads encountered are not uncommon in many daily experiences, though not in a repetitive, fatiguing manner. Really, the first repetition of a set of 6-12 repetitions or more to muscular failure is not all that challenging; it is only with increasing fatigue that the load begins to *feel* heavy. Another purported purpose for warming up is to allow neurological "priming" (i.e., rehearsal), and exercise-specific warm-up also mildly stretches the muscles to be trained. I prefer exercise-specific warm-ups as opposed to a general-body warm-up, but there is no evidence supporting or refuting this contention. *If* warming up, including stretching, is absolutely necessary prior to any lifts, I submit that those lifts would be a) a lift involving a previously injured body part, b) a lift performed ballistically (e.g., Olympic lifting), and/or c) a lift that takes a joint into a loaded extreme in range of motion (e.g., dumbbell chest presses). Also, if lifting early morning, warm-up the paraspinal muscles and "loosen up" the spine to optimize good posture during exercise and to reduce morning stiffness which could alter spinal biomechanics. Loosening up would be especially important for older persons with degenerative joint disease (i.e., osteoarthritis). Finally, extended whole-body warm-ups (~10 min) are recommended in well-supervised clinical settings when exercising patients with cardiovascular diagnoses (e.g., hypo/hypertension, angina, myocardial infarction).

Recent research has demonstrated that peak muscle force production *decreases* immediately following a stretching routine. Also, muscles generate *more* force when *cooler* as opposed to warmer. I'm uncertain the exact application of these data, but it would appear for powerlifters to perform optimally, very little warming up is best. Any increased risk of injury would have to be carefully weighed against a maximum lift, however.

In sum, nonballistic resistance exercise in a climate-controlled, closed environment may require less warming up than typically performed. Slightly more may be prudent if experiencing stiffness or if performing ballistic or near-maximal lifts. In effect, warm-ups should be designed to meet individual needs.

Brian D. Johnston

This is a complex question that must take into account several factors. I will, however, exclude the need for extra warm-up due to age (the elderly take longer to warm-up), injuries (it will take longer to get into a 'groove' when training an injured body part), and temperature. Primarily, the amount of warm-up ultimately depends on the muscle groups' rate of fatigue. You have probably noticed this, wherein some muscles are ready to go much faster than others. In my own training, I only need one set of 4-5 reps before training back, since I tend to have a high rate of fatigue (fast twitch) in that muscle group. Conversely, my lower body takes longer to fatigue (and, consequently, longer to produce optimum force output) and responds better to a longer warm-up, including 2 minutes of cycling and 4-5 sets of very low intensity simulation exercises. For thighs I have tried less warm-up, but performed worse, able to produce a higher load time with the same resistance by including multiple sets of easy warm-up.

You must also take into account the crossover effect exercises have on participating muscle groups. If one muscle group fatigues faster than another, you have to structure your warm-up accordingly. Using the above data as an example, my low back has a high rate of fast twitch (two standard deviations above normal in strength when tested), yet my low body has very good endurance capabilities. If I were to warm-up using squats exclusively, my low back would fatigue long before starting my actual work sets. Hence, I include a few minutes of cycling and some deep knee bends before doing any squat warm-ups to avoid premature low back fatigue. An associate of mine has a similar problem with his upper body, that his triceps are quick to fatigue (and very strong), whereas his pectorals are slow to fatigue and not nearly as strong proportionately. Prior to chest pressing, he performs only one light set of chests presses, but precedes this with two light sets of pec deck flyes. This allows him to warm-up around the weak link... his quick-to-fatigue triceps.

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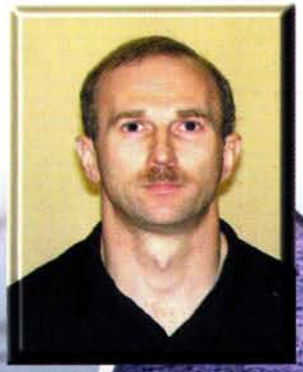

Matt Brzycki

Critics of low-volume training -- particularly that which involves single-sets-to-fatigue — have argued that it is both dangerous as well as unproductive because it does not involve one or more warm-up sets. It is important to differentiate between doing a warm-up set and doing a warm-up. Just because a person does not do warm-up sets does not mean that the person is not warmed up.

From a physiological perspective, an adequate warm-up is one in which the core temperature is increased by one degree. If you do a fairly high number of repetitions and the repetitions are done in a smooth, controlled fashion without jerking or heaving, then you'll actually warm-up as you do the exercise. A person who trains to fatigue will be adequately warmed up well before the end of the set. Personally, I have not done any warm-up sets of any kind since 1984. At a bodyweight of 172, I've done 20 repetitions with 289 pounds in the trap bar deadlift with no warm-up sets prior to that effort. In fact, that was my first set of the entire workout. It took me approximately two minutes to do those 20 repetitions and there's no doubt in my mind that I was adequately warmed up and prepared -- both physiologically and psychologically — to train to muscle fatigue. (Incidentally, that set was done at the age of 42 and without a weightlifting belt.)

My training partner, Tony Alexander, has done 20 repetitions with more than 410 pounds in the trap bar deadlift and 10 repetitions with his 235-pound bodyweight plus an additional 130 pounds in dips without any prior warm-up sets (and without a weightlifting belt). An exception to this would be when doing low-repetition sets. In this case, one or more warm-up sets should be done prior to the low-repetition effort.

Ken Mannie

The sparse research I have seen regarding warm-up procedures centers around activities such as swimming and the myriad aerobic and anaerobic running, cycling, etc., regimens utilized by both the general and athletic populations. I am in firm agreement that warm-up and, in many cases, stretching routines should precede such endeavors. However, it would be specious to state that all individuals need to partake in a general warm-up procedure prior to strength training. As per a recent discussion with Dr. Ted Lambrinides, the exception to this might be in the case of the elderly population — especially those with known circulatory problems.

Specific warm-up procedures for heavy, multi-set pyramiding routines and/or maximum lift attempts present a scenario where performance may be improved via the activation of congruent neural pathways. However, this result may be more of a skill issue than a warm-up issue. One of the true beauties of high-intensity training is that a warm-up is built into each set. When you take into consideration the moderate to high rep ranges recommended for most sets and the smooth, steady movement patterns consistent with the HIT protocol, you are basically accomplishing the goals of warm-up in the initial stages of the workout. This is especially true of upper body exercises. Some may choose to perform a general warm-up for the lower body musculature, due to the larger mass involved. If one chooses to perform either a general or specific warm-up — as precipitated by personal preference, injury concerns, or special need situations — the following considerations should be kept in mind: 1. A one to two degrees Celsius increase in central core temperature is desirable (this will be indicated by a mild sweat over the entire body); 2. Warm-up does not include the stretching exercises one chooses to incorporate — they are separate entities; 3. The warm-up procedure should not induce a fatigue factor that detracts from the performance goal of the workout.

Richard Winett, Ph.D.

Effective resistance training involves doing slower controlled repetitions with submaximal (not 1 RM) resistance. For example, a person may do 5 to 6 slower repetitions in different movements taking 60 to 80 seconds for the set. The point is that this is not weight lifting where the lifter may attempt a 1 or 2 RM, while moving explosively.

Consequently, much of the warm-up is provided by simply doing the exercise. Aside from some specific considerations, very little warming-up is needed. The considerations are the ambient temperature of the gym or the temperature that the person has just left before entering the gym.

Obviously, if either one is cold, then a person should consider some brief warm-up using any cardiovascular piece for about 5 minutes at an easy pace. Another approach, and I'm serious about this, is just standing in front of a space heater for a few minutes. The other exception for warming up is when beginning a workout with heavy leg or lower body work. Then one or two warm-up sets of a couple of submaximal reps each can be used.

After years of a highly ritualized warm-up routine including riding a stationary bike, stretching, and doing numerous warm-up sets for most movements, now I do virtually no warming up except for 2 sets of squats for 2 reps each on lower body days and one set for one or two reps of the first exercise I'll do in an upper body workout. The result is no injuries and much, much shorter workouts. Keep in mind that I only do slow controlled reps.

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