

THE MAGAZINE FOR ATHLETIC LEADERSHIP

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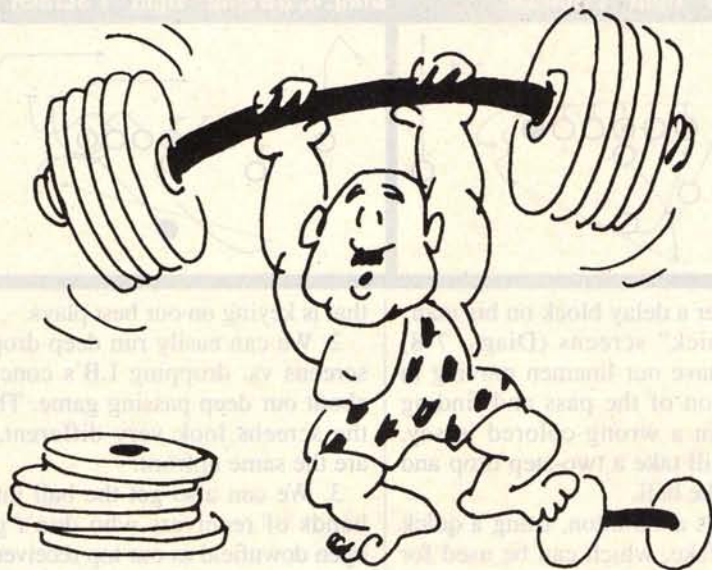
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# The Case Against THE ONE-REP MAX

*An unreasonable amount of stress is placed on the muscles, bones, and connective tissue*



THE MOST POPULAR (AND TRADITIONAL) way to assess dynamic strength is by determining how much weight an athlete can lift for one repetition.

Indeed, the one-rep maximum (1-RM) lift is perhaps the most frequently used test for evaluating muscular strength. Such tests are usually made up of three or four exercises representative of the body's major muscle groups.

For example, a bench press or an incline press is typically used to assess the strength of the chest, shoulders and triceps, while a squat or a leg press is often used to measure the strength of the hips and legs.

The 1-RM is also used as a measuring stick in strength programs that are based upon periodized or pre-planned workouts. Periodically, athletes are asked to max out and then incorporate various percentages of their 1-RM during differ-

ent phases or "cycles" of training.

For example, in Week #1, the athletes might do 3 sets of 10 reps in an exercise with 75% of their 1-RM; in Week #2, the athletes might do 4 sets of 8 reps with 80% of their 1-RM, and so on until they are performing a 1-RM. After obtaining a new 1-RM, the process begins again.

### **Inherent Problems**

Several inherent problems arise when athletes are asked to lift a maximal weight for one repetition:

**Orthopaedic Stress.** Attempting a 1-RM with heavy weights can place an inordinate and unreasonable amount of stress on the muscles, bones and connective tissues. Injury will occur when the stress exceeds the tensile strength of those structural components.

**Blood Pressure Response.** A 1-RM attempt tends to increase blood pressure beyond that normally encountered when using submaximal weights. These concerns are magnified when testing certain populations

such as younger adolescents.

**Skill Proficiency.** A 1-RM lift is a highly specialized skill that requires a great deal of technique, practice and patience. Athletes could make better use of their time by practicing and perfecting sport-specific skills such as shooting, throwing or dribbling.

**Time Involvement.** The process of obtaining a 1-RM is time consuming because of the number of warm-up sets preceding the maximum attempts. Again, athletes could spend this valuable time in sport-specific activities.

**Muscle In-Roading.** The amount of muscular fatigue — or "in-roading" — that is produced is critical in the development of strength. As the percentage of the weight being used approaches a 1-RM, the degree of muscular in-roading becomes less.

For example, reaching muscular failure with a near-maximal weight of 95% of a 1-RM means that an athlete made an in-road into more than 5% of his/her existing strength; conversely, reaching muscular failure with a submaximal weight of 75% of a 1-RM means that an athlete has made an in-road into more than 25% of his/her existing strength level.

### **A Safer Method**

Using the 1-RM, either as a testing method or a training protocol, is time-consuming, potentially dangerous and less effective in producing a desirable level of muscular fatigue. Clearly, coaches must identify a safe and practical means of testing and training large numbers of athletes in a convenient and time-efficient manner.

How can muscular strength be measured in a safe and practical yet reasonable accurate manner without having your athletes max out? The answer lies in the relationship between

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strength and anaerobic endurance.

There is a direct relationship between the percentage of maximal load (strength) and the number of reps-to-fatigue (anaerobic endurance): As the percentage of maximal weight increases, the number of reps decreases in an almost linear fashion.

The relationship is not exactly linear but close enough to determine a reasonably accurate linear approximation for describing the relationship between the two variables. In fact, the following mathematical equation can be used to predict a 1-RM based upon reps-to-fatigue:

$$1\text{-RM} = \frac{\text{Weight Lifted}}{1.0278 - .0278X}$$

where X = the number of reps performed

A study by LeSuer and McCormick (1993) at Washburn University (Kansas) revealed a high correlation for the bench press ( $r=.99$ ) and squat ( $r=.96$ ) exercises when using this formula.

For example, suppose a male athlete reached muscular failure after 8 reps with 200 pounds. First, multiplying the reps [8] by .0278 is .2224. Subtracting .2224 from 1.0278 is .8054. Dividing .8054 into 200 is about 248. Therefore, an athlete who did 8 reps-to-failure with 200 pounds would have a predicted 1-RM of about 248 pounds.

In other words, he can do 8 reps with about 80.54% (or .8054) of his predicted 1-RM. Regardless of whether his strength increases or decreases, he will always be able to perform exactly 8 reps with roughly 80.54% of his maximum.

If, therefore, he increases his 8-RM (his anaerobic endurance) by 20% [from 200 to 240 pounds], he'll also increase his 1-RM (his muscular strength) by 20% [from 248 to 298 pounds] ... and in a much safer fashion.

### Genetic Influences

Each individual inherits a different potential for increasing various physical attributes such as muscular size, muscular strength, cardiovascular endurance, and anaerobic endurance.

Indeed, an athlete's physical profile is largely determined by several inherited characteristics, including predominant muscle fiber type, muscle-to-tendon ratio,

limb length and neurological ability.

So, if predicting a 1-RM from a test of anaerobic endurance is to be more precise, individual differences (i.e., "genetic influences") should be considered. However, the aforementioned equation will still be quite accurate for predicting a 1-RM for most of the population.

### Testing Perspectives

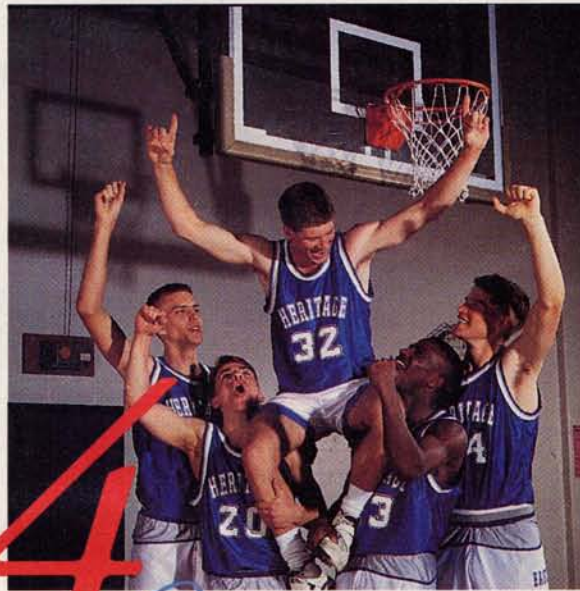
Attempting a 1-RM isn't really necessary to monitor the progress of your athletes. If your athletes are recording their workout data — and they should — you can simply check their workout cards to evaluate their strength levels.

The purpose of strength testing — and

strength training — should not be to compare the strength of one player to another. It's unfair to make strength comparisons between athletes because each person has a different genetic potential for achieving muscular strength.

Testing and training become much more meaningful and fair when an athlete's performance is compared to his/her last performance — not the performance of others.

Success in the sport of competitive weightlifting is determined by the ability to lift as much weight as possible one time. Athletes who don't participate in weightlifting competitions have no business performing a one-rep max. ■



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