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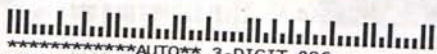
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Which are Better: Free Weights or Machines?

By Matt Brzycki

The two most popular types of equipment that are used for weight training are free weights (i.e., barbells and dumbbells) and machines (either selectorized or plate-loaded). Accompanying their popularity is a fiery and emotional debate that has raged for decades over which of the two modalities is better for weight training.

ISSUES AND ANSWERS

Why the squabble? Much of the debate centers on two major issues: muscular response and athletic specificity.

Muscular Response

How many times have you heard that free weights are more advantageous for building muscular size and strength whereas machines are merely for toning and shaping muscles? Is this a reasonable assertion?

In order to examine this matter, it is first necessary to understand the requirements for increasing the size and strength of muscles. Stimulating these desired myological improvements is not really all that complicated. First of all, a resistance (or "load") must be applied to a muscle. Second, the resistance must be made progressively more challenging from one workout to the next. It is that simple. Certainly, other ingredients are also important in a weight-training program. But in order for you to improve your muscular size

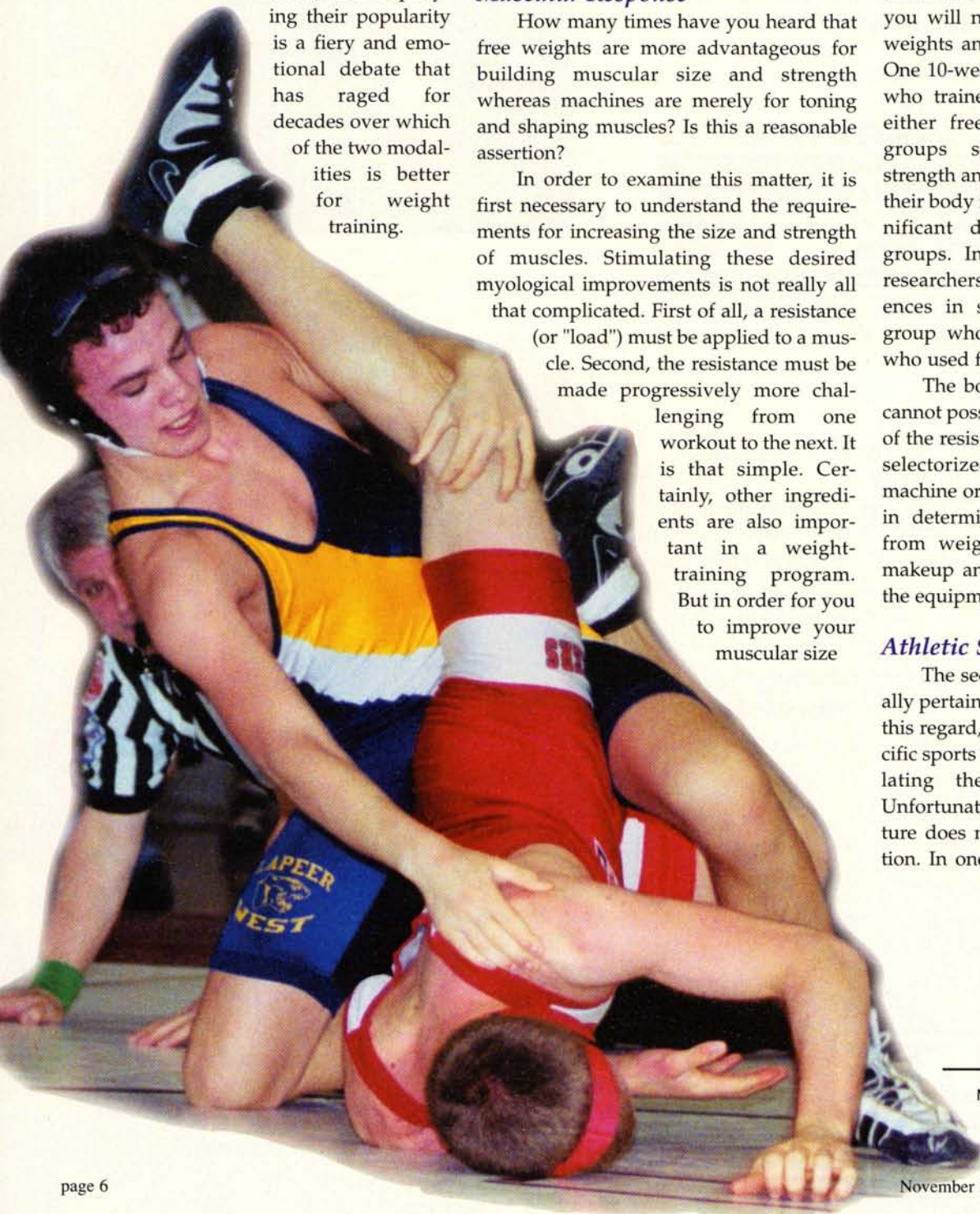
and strength, the two most basic requirements are that your muscles must first be loaded with a resistance and then progressively overloaded.

What about the nature of the resistance? A number of studies have shown that you will not develop one way with free weights and another way with machines. One 10-week study compared two groups who trained three times per week with either free weights or machines. Both groups significantly increased their strength and lean-body mass and decreased their body fat. Moreover, there were no significant differences between the two groups. In another 10-week study, the researchers found no significant differences in strength increases between a group who used machines and a group who used free weights.

The bottom line is that your muscles cannot possibly "know" whether the source of the resistance is a barbell, a dumbbell, a selectorized machine, a plate-loaded machine or a cinder block. The sole factors in determining your muscular response from weight training are your genetic makeup and your level of intensity - not the equipment that you used.

Athletic Specificity

The second area of controversy generally pertains to the concept of specificity. In this regard, some individuals feel that specific sports skills can be improved by simulating them with added resistance. Unfortunately, the motor-learning literature does not seem to support this assertion. In one study, competitive swimmers



Michigan - 130 lb. David Schland, Lapeer West, won by a fall in 1:18, over Tyler Stevensville, Lakeshore. Photo by Gail Ranger.

were filmed while sprinting the butterfly. The films were digitized and analyzed by computer. Among other things, it was found that swimming with added resistance was done with noticeably different - and less effective - stroke mechanics compared to swimming without added resistance. In effect, the swimmers were performing a totally different skill.

The same result occurs when attempting to mimic the movement pattern of a particular sports skill in the weight room with a barbell or a dumbbell. The fact of the matter is that no exercise done in the weight room - with a barbell, dumbbell or machine - will help you to improve your wrestling skills. At best, this is a waste of time and energy.

Another related argument is that balancing a barbell or a dumbbell is advantageous because this balance will transfer or "carry over" to sports skills. Once again, the relevant research does not appear to confirm this claim. In one study, researchers examined six tests of dynamic and static balance and found that the abilities supporting one test of balance were separate from those supporting another. In other words, the ability to balance a barbell is quite different from the ability to maintain your balance on the mat. Adds John Thomas, the Strength and Conditioning Coach at Penn State (for football), "[Using] free weights may develop general balance but not specific sport skills."

The next time that you watch other wrestlers, see if you can tell which ones use free weights, which ones use machines, which ones use a combination and which ones use no type of weight training whatsoever. Obviously, it would be impossible to tell because the source of resistance matters very little, if any, in an athlete's response to weight training.

PROS AND CONS

That said, there are a number of pros and cons to both free weights and machines which may have an impact upon your choice of equipment.

Advantages of Free Weights

Free weights have the following advantages over machines:

1. If you are a coach who is trying to outfit a weight room with a limited or tight budget, the most important consideration in your choice of equipment may very well be the cost. Machines are generally much more expensive than free weights. You

could easily pay more than \$40,000 for a complete "line" of state-of-the-art selectorized equipment (10 - 12 machines). That same number of plate-loaded machines would be much less expensive but remember a possible "hidden" cost: You may need to purchase a few thousand pounds of plates to serve as the resistance for the machines. A considerable amount of free-weight equipment could be purchased for much less of an investment.

2. Most machines that are geared toward commercial use are designed to perform only one or two functions. A bicep-curl machine, for example, can only be used to exercise the biceps. In comparison, a bar and several hundred pounds of plates can allow you to perform movements for just about every muscle in your body. So, free weights give you more variety per dollar.

3. It is safe to say that when it comes to free weights, "one size fits all." Indeed, free weights can accommodate just about everyone regardless of their size from your largest wrestler to your smallest. On the other hand, athletes who are at an extreme in terms of skeletal height and/or limb

length may not be able to fit properly on some machines. For this reason, machines present a major drawback for many adolescents who wish to strength train.

4. Balancing free weights requires a greater involvement of synergistic muscles. Keep in mind, though, that the significance of this remains unclear. Ken Mannie, the Strength and Conditioning Coach at Michigan State, points out that "the rate and level at which [the synergistic muscles] act merit additional study."

Advantages of Machines

Machines have the following advantages over free weights:

1. Some exercises can only be done with machines including hip abduction, hip adduction, hip flexion, leg curl, leg extension and lat pulldown as well as those for the neck. These exercises and others have a valuable role in a comprehensive weight-training program.

2. Most machines can provide variable resistance. As an exercise is performed, the biomechanical leverage of your skeletal system changes - which makes the movement feel easier in some positions and

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harder in others. A properly designed machine automatically varies the resistance to match the changes in your biomechanical leverage. In positions of inferior leverage (and inferior strength), the machine creates a mechanical advantage and a lower level of resistance; as your skeletal system moves into a position of superior leverage (and superior strength), the machine creates a mechanical disadvantage and a higher level of resistance. The end result is greater muscular effort throughout the range of motion (ROM). During a typical free-weight exercise, there is adequate resistance for your muscles in their weakest positions but not enough in their strongest positions. Because of this, the amount of resistance that you can use is limited to that which you can handle in your position of least leverage. There are, however, a few free-weight exercises that provide somewhat adequate resistance throughout most of the ROM including wrist flexion/extension, shoulder shrug and calf raise.

3. As noted previously, you are required to balance the resistance when using free weights. Having to do this can be viewed as a drawback. Some athletes - particularly those who have very little

experience in weight training - might worry more about balancing the resistance than about performing the movement properly. Furthermore, you are likely to spend excessive energy in balancing the weight. With most machines, the weight is already balanced for you so that you will be able to concentrate on the proper performance of the exercise. By not involving synergistic muscles when the weight is balanced, machines can also work the target muscles to a greater degree.

4. Workouts are generally more time-efficient when machines are used. Some athletes do not have an abundance of extra time to spend in the weight room - especially during the season. The resistance on machines can be set by simply moving a selector pin rather than by fiddling around changing plates.

5. In general, machines provide direct resistance over a greater ROM compared to a similar free-weight exercise. A machine pullover, for example, can provide direct resistance over as much as 270 degrees ROM around your shoulder joint. By comparison, a barbell or dumbbell pullover provides only about 100 degrees of direct resistance for the same musculature - that is, your latissimus dorsi or, simply, your "lats." Therefore, a pullover done on a machine is much more efficient than a pullover done with free weights because the targeted muscles are exercised over a greater ROM. This holds true for just about all machine exercises compared to their free-weight counterparts.

6. Many free-weight exercises do not provide the targeted muscles with an adequate stretch. For instance, a barbell bench press restricts the stretching of your chest muscles - you could stretch them further but are unable to do so because the bar must stop at your chest. Almost all machine-type bench presses utilize movement arms with an opening for your chest. This enables you to obtain a greater stretch so that you do not compromise your flexibility. It should be noted that performing free-weight exercises with dumbbells can allow you to obtain a better stretch than with a barbell.

7. Machines are more practical than free weights during rehabilitation. Suppose that you injured your left knee. Many free-weight exercises would be quite difficult or uncomfortable (if not impossible) to perform. However, you could still train your entire upper torso, your right leg and pos-

sibly even both hips if you have access to machines. You could even continue to exercise on most machines with very little discomfort even if your arm or leg was in a cast. For instance, if your wrist was casted such that you were unable to grasp a barbell or dumbbell, you could still perform many upper-body exercises on machines including the "pec dec," pullover and lateral raise.

8. For reasons of safety, any barbell exercise that involves lifting a weight over your head - such as a bench press or a seated press - should only be done with a spotter. With machines, a spotter is rarely needed because it is virtually impossible to get pinned underneath a bar or stuck with a weight in a compromising position. It should be noted that overhead lifting can be done with dumbbells without requiring a spotter for safety.

SO, WHAT'S BETTER?

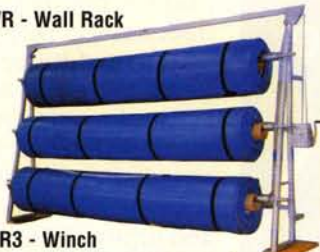
There are advantages to both free weights and machines. No doubt, some coaches and athletes will always prefer one more than the other and that's all right as long as the favoritism is not born out of misconceptions or commercial bias. Remember, the bottom line is that your muscles do not respond one way with free weights and another way with machines. To quote Dan Riley, a strength and conditioning coach who has spent more than 20 years in the National Football League, "The equipment used is not the key to maximum gains. It's how you use the equipment."

So, keep an open mind when it comes to selecting equipment for weight training. If you do not have a preference, then vary your workouts with free weights and machines.

Matt Brzycki has been involved in the strength and conditioning of collegiate wrestlers for more than 20 years. Since 1986, he has authored more than 70 articles for *Wrestling USA Magazine*. Reprints of 42 of these articles have been updated and adapted into book form (*Wrestling Strength: The Competitive Edge* and *Wrestling Strength: Prepare to Win*) and are available through Cardinal Publishers Group (317-879-0871). He is also the author of *A Practical Approach to Strength Training* and the editor of *Maximize Your Training*, a 455-page book that features chapters written by more than 30 strength and fitness professionals. 🐾

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