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Intensity vs Work in Exercise

Often I must explain the answer to the following question: "Isn't it beneficial to expose the muscles to heavier weight by permitting ample rest between exercises? After all, I can perform each exercise with more weight if I rest several minutes between each exercise." As you continue this chapter consider this to be the primary question.

For many years the *total tonnage theory* was popular. It epitomized the belief that the total work performed or weight (tonnage) lifted daily was a gauge for measuring exercise effectiveness and/or progression.

Both the primary question and the total tonnage theory ignore the true cause and effect relationship between the exercise stimulus and the growth response mechanism.

Muscular growth occurs through a mechanism that we yet poorly understand. We do know, however, that the growth mechanism in healthy subjects is a response to working muscle in a high-intensity fashion.

High-intensity muscular work is therefore the stimulus, and muscular growth is the response. Realize that high-intensity work does not cause or produce growth. Your body produces the growth in response to the provided stimulus.

No amount of easy activity effects the desired growth stimulus. For example, pretend that you wish to grow a callous on your hand. No amount of light stroking your palm with a feather will result in callous formation. But find something abrasive — a key perhaps — and scrape it across your finger pads so hard that it nearly breaks the skin. This stimulates callous formation that will occur if you wait several days and do not continue to abrade your palm to the point of blisters.

The mechanism of muscular growth works much the same way. You must work muscles hard to effect stimulation, then back off and permit the body to grow the muscles larger and stronger.

Intensity merely indicates how hard the muscular work or its degree of difficulty. The effectiveness of growth stimulation appears to be directly proportional to the intensity of muscular work during exercise. It is indirectly proportional to the amount of work.

Intensity may also be equated with inroad per time:

Intensity = inroad/time.

This means that the greater a muscle is fatigued in a limited time frame, the greater the exercise intensity.

Consider the primary question again and then study the following scenarios. The explanation is somewhat tedious. Carefully read it several times to ensure accurate meaning.

Scenario #1 (Refer to the Scenario #1 Table below.) Suppose you perform five exercises to the point of muscular failure and rest 5 minutes between each exercise. Also assume that you inroad your strength 20% in each exercise.

Fresh strength is the maximum one-repetition force you can generate if the muscles involved are completely fresh — rested. Suppose that rather than perform a set of five repetitions, you can perform only one repetition using as much weight as your strength will allow: pretend that weight is 100 units (or 100%). Also suppose that you can perform exactly 5 repetitions with a 20% reduction (80 units or 80% of fresh strength). This is the weight we choose for the

Scenario #1 Table

Exercise	#1	#2	#3	#4	#5
Fresh Strength	100	100	100	100	100
Starting Strength	100	100	100	100	100
Weight X Repetitions	80 x 5	80 x 5	80 x 5	80 x 5	80 x 5
Ending Strength	80	80	80	80	80
Depth of Inroad$_s$	20%	20%	20%	20%	20%
Depth of Inroad$_f$	20%	20%	20%	20%	20%

Total Work = 2000 units

exercise set — denoted *Weight X Repetitions.*

Having performed 80 units five repetitions you cannot perform a sixth repetition, thus your strength has fallen to 80 — denoted *Ending Strength.* Your ending strength is actually somewhat less than 80, but for the sake of simplicity assume that inroad is exactly 20%.

Further pretend that your fresh strength is 100 units in each of all five successive exercises. This, of course, assumes that you do each of these exercises first, and you are not fatigued the slightest by preceding exercise(s). Assume, however, that a rest of exactly 5 minutes is also adequate to completely replenish your strength. Thus you are able to perform 5-repetition sets with 80% of fresh strength in each successive exercise if provided a five-minute rest between the exercises.

Comparison

Comparing scenario #1 to scenario #2, note that the depth of inroad from the fresh strength levels are significantly greater when the rest interval is eliminated. This presumably indicates a more certain and thorough growth stimulation.

Also, note that the overall work performed is less when the muscles are worked harder — no rest between exercises. This is valuable since the amount of work is a major negative factor affecting our limited recovery system. If the recovery system is depleted too far by excessive work, growth is retarded, minimized, or prevented in spite of effective stimulation.

One more benefit: the high-intensity workout outlined in scenario #2 exposes the body to less force — excepting the first exercise. Since excessive force is primarily the result of acceleration — sudden, jerky movement — this is a minor benefit, but a benefit nevertheless.

Scenario #2 Table

Exercise	#1	#2	#3	#4	#5
Fresh Strength	100	100	100	100	100
Starting Strength	100	95	90	85	80
Weight X Repetitions	80 x 5	76 x 5	72 x 5	68 x 5	64 x 5
Ending Strength	80	76	72	68	64
Depth of Inroad$_s$	20%	20%	20%	20%	20%
Depth of Inroad$_f$	20%	24%	28%	32%	36%

Total Work = 1800 units

Starting strength is the maximum one-repetition force you can generate in each exercise after you have weakened the involved structures by preceding exercise(s). Then the corresponding 5-repetition sets are performed with 80% of starting strength rather than 80% of fresh strength. Of course, if totally recovered by virtue of the five-minute rest between exercises, starting strength equals fresh strength and the 80% figure is the same in each exercise.

Depth of Inroad$_s$ is the percentage of inroad from the starting strength in each exercise.

Depth of Inroad$_f$ is the percentage of inroad from the fresh strength in each exercise.

Scenario #2 (See the Scenario #2 Table.) Scenario #2 is identical to Scenario #1 except that no rest is allowed between the exercises.

Fresh strength remains the same, of course. Starting strength after the first exercise, however, is somewhat less than fresh strength due to the inroading influence of the preceding exercise(s). This inroading influence becomes progressively greater as the workout proceeds to subsequent exercises.

And the *Weight X Repetitions* decreases as we take 80% of the ever-diminishing starting strength. Therefore the resulting inroad from the original fresh strength level grows progressively greater.

Summary

Deep muscular stimulation is enhanced when exercises are performed to failure with a minimum of rest between them. Also, less total work is performed from which the body must recover. Of course, these observations ideally ignore the limitations of the ventilation and vascular sub-systems to permit such continuous work.These sub-systems are often the limiting factors in the pure application of these principles.

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