Acute Training Variables, Muscle Growth, Strength, and Power - Intensity

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Resistance or Intensity Used

Muscle growth and strength

The intensity or resistance used refers to a percentage of your maximal effort when lifting. For example if an individual can bench press 200 pounds once, then 80 % intensity would refer to 160 pounds. Intensity has a large effect on muscle growth. Briefly it is important to know that muscle tissue is comprised of both type I or slow twitch, and type II or fast twitch muscle fibers. Generally types 1 are recruited at lower intensities, while large intensities are needed to recruit type II fibers. The effects of the selected intensity can be seen by comparing bodybuilders, with weight lifters, and power lifters. Bodybuilders generally lift in a higher repetition range (8-12 repetitions) which corresponds to about 70-85 % 1-RM (6-12 reps). Weight lifters and power lifters often perform repetitions at ≥ 90 % intensity or ≥ 1-5 repetitions. In an extensive analysis Dr. Fry found that the majority of the muscle mass in power lifters and weight lifters was contributed from type II muscle fibers, with a much smaller contribution coming from type I fibers. It is suggested that the extremely heavy loads used by power lifters and weight lifters mainly stimulate type II fibers to grow, but not type I. In contrast bodybuilders had an equal portion of their muscle occupied by type I and type II fibers, indicating that they had caused growth in both muscle fiber types. In addition when looking at individual fiber size by looking at the type II to I fiber ratio, it can be seen that strength athletes had much greater size of type II fibers than type I, while power lifters type II fibers were only slightly larger than type I fibers (Figure 3).

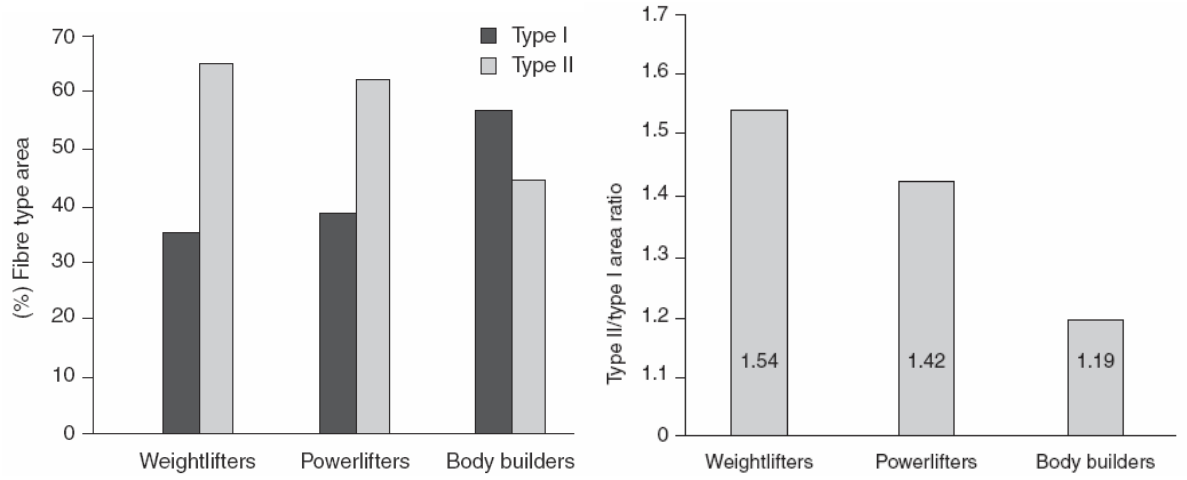

Figure 3.0 Relative (%) fiber type area, and ratio between type II and I fibers for competitive lifters (i.e. weight lifters, power lifters and body builders). Graph from Fry [1]

Dr. Fry also analyzed numerous studies on muscle growth of both type I and II fibers and found that there was a dose dependent response between intensity and muscle growth. However if you look at the graphs below you will note that most of the growth tends to cluster around 80-85 % maximal intensity or about 8-12 repetitions.

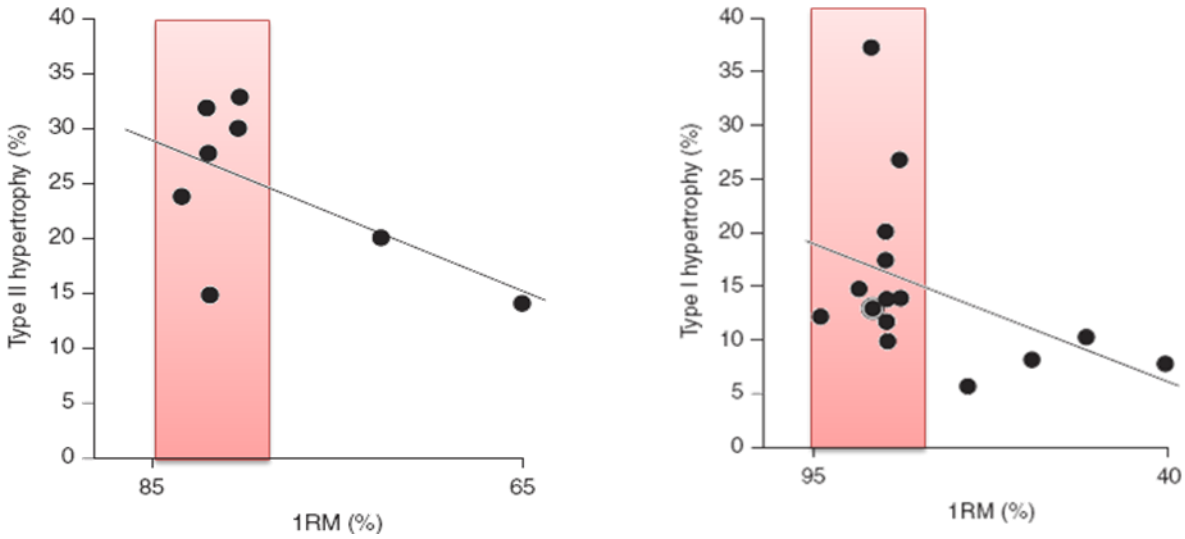

Figure 4.0 Dose dependent response between intensity and type I and II fiber growth. Modified with red highlight from Fry [1]

Another method for looking at the effects of intensity is to analyze how this variable affects hormone release. For example studies show that while 10 sets of 10 repetitions were able to stimulate large increases in both growth hormone and testosterone, 20 X 1

repetition sets were not [2]. Similarly 10 repetition sets are able to stimulate GH release, while 5 repetition sets are not [3]. Again, this appears to be stimulated by greater increases in lactic acid following the 10 repetition sets than compared to both the 5, and 1 repetition maximum sets[2]. Overall the general consensus is that strength is maximized at 1-5 repetitions, and overall growth at 6-12 repetitions[4]. This does not however mean that bodybuilders should not train in the 1-5 repetition range, as clearly data from power lifters and weight lifters indicate that this is a strong stimulus for the larger type II muscle fibers to grow. For this reason bodybuilders should dedicate considerable time lifting in a strength range, but probably not more than 1 out of 3 sessions.

Power training and its relation to muscle growth

Power is a function of work (force X distance) over time, and is therefore dependent on how rapidly an individual can increase force output. The optimal combination of force and velocity occurs at 40-60 % of an individual's 1 repetition maximum[5]. At this weight an individual can rapidly accelerate the bar. Not only does this increase power, but it also has a number of possible indirect benefits for muscle growth. First it should be understood that power training results in very little muscle growth[6], mainly because the weights lifted are not great enough to stimulate a remodeling of muscle tissue. However the advantage to power training is that unlike strength routines (1-5 repetitions at 85-100 % 1-RM), power routines actually stimulate similar increases in testosterone as hypertrophy routines (8-12 repetitions at 70-85 % 1-RM), with very little cortisol increases [6]. The reason is that testosterone enhances neural function[6]. For this reason after an extreme muscle damaging workout, it may be optimal to perform a power workout a few days later; this will stimulate an anabolic hormone release which will increase the muscle growth from the previous training session, while not causing further muscle damage!

Percentage of 1-RM or Repetition Ranges?

One question for the bodybuilder is whether they should base their training on a percentage of their 1-RM, or rather base it on a repetition range. Fleck and Kraemer[4] argue that repetition ranges are more efficient as training experience can have significant effects on the amount of reps you can lift at a given % of your 1-RM. For example: in one study trained power lifters could lift 22 reps at 80 % of their 1-RM in the leg press, while untrained individuals could only lift 12 repetitions[4]. Further, through extensive analyses of numerous studies[7, 8] it was found that strength was optimized at 60 %, 80 %, and 85 % in untrained, moderately trained, and advanced athletes respectively, suggesting that a greater stimulus is needed with increased training status. For this reason repetition ranges are most likely more efficient than using a % of a 1 RM effort.

Table 2.0 Take Home Messages for Exercise Intensity

❖ **For Muscle Growth a range of 6-12 repetitions or 70-85 % maximal intensity is optimal**
❖ **For Strength a range of 1-5 repetitions or 86-100 % intensity is optimal**
❖ **For Power a range of 1-5 repetitions at 40-60 % of maximal intensity is optimal**
❖ **While the major focus of bodybuilders should be training within the hypertrophy repetition range, a considerable amount of time (at least 1 of 3 workouts) should be dedicated to strength routines as this seems to cause selective growth in the larger, type II muscle fibers**
❖ **Finally power type repetitions are excellent tools to use between hardcore workouts as they cause little muscle damage and yet produce an equal amount of testosterone as hypertrophy training. Thus they serve as a way to maintain a high anabolic environment in the target muscle groups without overtraining. They may also enhance type II muscle fiber growth.**

References

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