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Train Right for Your Type

by Ian King

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The subject of muscle fiber types and their role in weight training can be a complicated and sometimes confusing issue. Here's a quick and, admittedly, very general primer. The fibers in your muscles are "typed" according to their oxidative capacities and how fast they fatigue. Typically, fast-twitch (type-II) fibers respond best to heavy, low-rep training.

In other words, fast-twitch fibers are recruited in the performance of high-intensity, short-duration bouts of work, like heavy lifting and sprinting. Usually, if you hear someone refer to a bodybuilder as "gifted," one of those gifts is an inordinate amount of fast-twitch fibers. These are the "good ones." If your goal is to be big and strong, then you probably long for a high fast-twitch fiber makeup.

Slow-twitch (type-I) fibers respond best to higher reps and are recruited for endurance bouts typified by aerobic activity or long sets of exercise. Picture predominately slow-twitch individuals as long distance runners. On the other hand, fast-twitch guys would be those muscular sprinters at which we all gape in awe during the Olympics. Of course, everyone has both fast- and slow-twitch fibers, but some individuals will genetically lean either direction. In a similar vane, individual muscles such as the hamstrings are made up of both fiber types, but they tend to be predominantly fast-twitch in most people. This means the hammies probably respond better if you use heavy weights and low reps.

We've asked Ian King to delve further into the issue of muscle fiber types, testing, and training — and boy, did he ever! This is a long article, but if you stick with it, we guarantee you'll know more about fiber types and how it relates to training than the average physiology PhD.

Try this experiment. The next time you're at a professional football game, stroll into the locker room during halftime. No one will mind. Once you get everyone's attention, conduct the following survey. Ask the NFL players to raise their hands if they are of the homosexual persuasion. Carefully count the raised hands. Now ask them to raise their hands if they consider themselves "predominantly heterosexual." Again, count carefully. Now thank them kindly and tell the coach he can go back to his X's and O's.

So, what do you think the results of your test will be? I would say that if you polled 50 players, oh, about *50* hands would have gone up for the straight option! (Funny, that.) Believe it or not, the same thing happens in my seminars when I ask attendants to raise their hands if they think they're fast-twitch. No one will own up to being a slow-twitch! Slow-twitch people attend my seminars, of course, but they're "in the closet."

These days, everyone wants to know about the reds and whites of muscle fibers. In fact, I was asked within the space of weeks to write articles on the subject by three major magazines. Most are interested in what are known as "field tests." These tests allegedly tell you what type of muscle fibers you predominantly possess, fast or slow, based on various strength-training exercises. Some even have guidelines for your training, based on the "score" of your test. Field testing for muscle-fiber type isn't new, it just appears that it's being recycled.

But here's the problem: If I write what I really think about these tests, as opposed to what the magazines *want* to hear, they probably wouldn't publish it. Despite this, I've decided to tell the whole truth and nothing but the truth in this article. So if you're reading this, the editor has balls!

Fiber Type and Field Testing, Socrates Style

I'm going to discuss the issue of field tests for fiber type and the subsequent influence on training by asking and answering a series of questions.

How important is it to be a fast-twitch fiber person?

Before you state the obvious, e.g. you'd love to be Michael Jordan, set records, make millions, and sell long-distance plans and underwear for a living, consider the following:

You don't have to be a fast-twitch person to be good at sports! Only sports or sporting positions at the extreme end of the power/capacity continuum really need to be dominant either way. Yes, top marathon runners have a large slow-twitch makeup, and elite level sprinters are fast-twitch freaks, but there're a hell of a lot of sports in between where the athletes display a more "average-person" distribution and succeed. Sports require more than just extreme fast-twitch capacity! Even in a mixed-need sport where the athlete may be fast-twitch challenged (a politically correct way of saying that white boys can't jump) there are many other factors that the athlete may possess in higher quantities relative to their competitors that negate the lacking in white (fast-twitch) muscle.

Fiber type alone is a limited predictor of performance! There're many factors in sport that contribute to success, so it's impossible to be able to predict performance on the grounds of hypertrophy or percentage of muscle type. That's the conclusion by Robert Colling in his review of distribution of human muscle fiber type (1997). Colling writes, "Due to the complexity of most functional and sporting activities, there are a number of physiological and psychological factors that compromise each performance; therefore muscle fiber is just one small piece of an extremely complex jigsaw."

The message is clear. There's a role in life for those with less than extreme levels of fast-twitch fiber. You don't have to lie about it or be ashamed! You can come out of the closet now, form support groups, and march in your very own parade!

If you score as a slow-twitch person on a field test, are you <u>really</u> a slow-twitch person?

Are the strength-type field tests truly accurate? Are there other factors to consider? Let's take a look at it.

Fiber type function is influenced by training. While fiber type distribution is believed to be predominantly genetically determined, there're a lot of ways that training can influence the *function* of these fibers. Take the type-IIA fibers for example, also known as the fast oxidative glycolytic (FOG) fibers. They're distinguished by their possession of characteristics from both fast and slow-twitch fibers. They're also known for their transitional nature. They've long been believed to be subject to training influence, i.e. to act more slow or fast-twitch depending upon training history, particularly in the formative, younger years. Then there's the more recent discussion of the type-IIB undergoing transformation to type-IIA, type-I transforming to type-IC, and type-I decreasing with a relative increase in type-IIC. Get the idea? Clear as mud? The point is, the field test may tell you as much, if not more, about your *training history* than it does about your actual fiber type!

Specific training adaptations may override the test intent. Your specific training background on the test activity may bias the score. Take the bench press for example. If your historic average rep range has been between six and eight, you may be assessed more slow-twitch if the test is conducted at reps between two and four.

Familiarity with the exercise may bias the test. The familiarity with the skill of the test action may bias the test if it was used to compare with others, and in some ways may bias the interpretation of the test full stop.

A recent layoff or level of peaking may also bias the test. Periods of detraining have been associated with atrophy of muscle fiber, more specifically of certain types of fiber. The experts appear to be in conflict over which fibers are most affected by a layoff. Colling concluded that it was the type-I fibers more than the type-II that will experience greater atrophy. Fleck and Kraemer (1997) concluded that it might be the type-II fibers that may atrophy to a greater extent. Whatever, the timing of the field test relative to your training peak and any layoffs will influence its outcome.

The velocity of the movement of a strength exercise may not be fast enough to discriminate. The work of Bosco, et al (1982), suggested that slow-twitch fibers may be able to sustain cross bridge attachments for longer periods than fast-twitch. The inference is that slow-twitch fibers would be more suited to slow speed movements. (In fact, this may be one way ascertain the fiber type in a field test — a person who score is higher from a slower, deeper knee bend than a faster, shallow one may be consider to be "slower twitch"!) On a speed continuum, a maximally loaded strength exercise such as a bench press is a relatively slow-speed movement and may not, therefore, be able to adequately discriminate fiber type. Siff and Verkhoshansky (1996) suggests that the slow-twitch contribution rises as the muscle contraction time increases from 100 to 1,000 milliseconds, while in more ballistic movements with maximal voluntary efforts (such as a vertical jump), the fast-twitch fibers are the main contributors to force production, and therefore, may offer a better opportunity to discriminate between fast and slow-twitch fibers.

A number of researchers have noted a significant relationship between fiber type and performances in power events, therefore confirming that the athlete with the higher fast-twitch fiber component will dominate in power performances in comparison with the athlete with less fast-twitch muscle fiber (Gollnick, et al, 1972; Saltin, 1973; Thorstensson, 1976; Komi, 1979; Mero, et al, 1981; Gerard, et al, 1986; Vandewalle, et al, 1987).

Bosco, et al (1982d), suggest that people with a high percentage of fast-twitch fibers in their leg muscles show a greater plyometric effect in jumping when the eccentric phase is rapid, the range of movement is small, and the coupling time is brief. In contrast, people with a high percentage of slow-twitch fibers perform better in jumping when the eccentric phase is slow, the range of movement is larger, and the coupling time is longer (longer crossbridge attachment time).

Maximal loading in strength exercises not as related to fiber type. Siff and Verkhoshansky (1996) summarized research by Thihanyi, et al (1982), that suggested that there was a significant relationship between fast-twitch fiber percentage and power output of the leg extensor muscles when working dynamically at loads exceeding 23% of the maximal isometric-force maximum, but this relationship disappeared when the load increased to over 40% of the force maximum. They concluded that no relationship has been found between maximum force production and muscle-fiber composition, and that muscle cross-sectional area may be more important for production of maximal strength, *regardless of muscle composition.* On the other hand, power or explosive maximal strength is more of a reflection of fast-twitch fiber. The loading involved in the strength exercise may elicit fast-twitch fibers, but the relative slow contraction speed may increase slow-twitch involvement.

Even muscle biopsies can be called estimations, so where does this leave field tests? How accurate are the field tests? Let's take a brief look at the real thing, the muscle biopsy. The distribution of the various types of muscle fiber within each muscle is varied, influenced by such things as depth. Deeper fibers appear to have a higher proportion of type-I fibers. Because of this heterogeneity of fiber distribution, fiber-type determination from a single biopsy should be considered only an estimate. So if there are some estimations in this very invasive and scientific lab test, where does this leave the lowly field test? In reality, it leaves it with an even lower degree of accuracy.

What effect do ergogenic aids have on the test performance? For example, what if the person being tested is using growth hormone? GH is known for its potential to significantly increase relative strength, i.e. strength increases in the absence of significant size changes. This may bias the result towards suggesting the person has a high content of fast-twitch fibers. Is the field test a reflection of their genetically determined fiber distribution or their drug use? Conversely, if the subject is using creatine (and the effect they receive is an increased work capacity), they may appear to have a higher slow-twitch fiber content. Now, how many athletes do you think participate in these tests in the absence of any ergogenic aids? That's right, your high-school shop teacher with the missing digits could count them on one hand.

Now add in the factors of age and sex and you see things getting complex in a hurry. So in summary, using a field test as a stand-alone indicator of fiber type can be very misleading. Is the test measuring training history or your genetic disposition? The above concerns and criticisms may not be groundbreaking and could even be described by some as nothing more than nit-picking. But the following discussion cannot be dismissed as easily.

What if you really are a slow-twitch fiber person? Do you want to reinforce it?

Let's say for example that the field test concluded you were a (*gasp!)* slower-twitch person. Are you then going to use training methods that reinforce it by using higher reps? Some suggest you do, but I say that's crazy! Here's why:

Strength training, as an anaerobic form of training, has great potential to reverse or do exactly the opposite of what endurance training will do. Strength training can teach your muscles to function more fast-twitch, irrespective of your genetic makeup. If I conclude an athlete is less than gifted in the fast-twitch fiber department, am I going to give them a program that will further disadvantage them by selectively training their slow-twitch fibers? Hell, no, I'm going to do all I can to "encourage" their body to produce force more like their more explosive colleagues!

Hypertrophy may be more apparent in fast-twitch than slow-twitch fibers. Now you might be saying that you're more interested in getting bigger than improving function or power. While hypertrophy can occur in both slow and fast-twitch fibers, most agree that fast-twitch fibers are more responsive to a hypertrophic response from strength training. So why ignore this option by using so-called slower-twitch fiber training?

If hyperplasia is going to occur, it's more likely to occur in response to fast-twitch type training. Ever since physiologist Gonyea raised the possibility of hyperplasia (i.e. muscle fiber *splitting* as opposed to hypertrophy, which is the fiber increasing in size as a single fiber) in 1980, the debate has raged as to whether it does, in fact, occur in human muscle fiber. I'll leave that debate to the experts. Fleck and Kraemer concluded that it's possible that only high-intensity resistance training can cause hyperplasia and that type-II muscle fibers may be targeted for this type of adaptation. Hyperplasia gives another possible option for getting bigger muscles in addition to hypertrophy, so why negate it by going the higher-rep option?

By now it should be clear that you should take the results of field tests as an interesting assessment only, not as the end-all, be-all answer to your muscle fiber makeup. You should also conclude that if you really are a slow-twitch person, you should not reinforce it with slow-twitch, high-rep training. I like to see an alternative given when a solution is taken away, so that leads us to the next question.

Okay, Mr. Smarty Pants, so what's a better testing alternative?

There's a very fine line between the fiber types and their function as far as strength training is concerned, so I'm not sure if loading at this velocity is going to adequately discriminate. For example, one of the more recent observations of strength training adaptations is for type-IIB to "transform" into type-IIA. This suggests perhaps that strength training isn't as extreme a fast-twitch activity as some may perceive it to be. So if you want to move further to the end of the power/capacity continuum, a more true type-IIB activity may provide a more accurate assessment.

Also, the adaptability of inherited fiber distribution to strength training may not allow the test to differentiate between a specific training adaptation and genetically determined distribution. Does strength training impact on the slow-twitch fibers at all? According to Fleck and Kraemer, the range of impact of at least "heavy" resistance-training programs is between type-IIA and type-IIB. So what any loaded external resistance strength test can only really hope to do is discriminate between the type-II fiber continuum. The issues raised above suggest it may be too much to interpret the field strength test as reflection of the individual's positioning on the type-II continuum.

So an alternative may be to use a higher velocity assessment, such as a power test like the vertical jump. If using norms for comparison, the age and sex (and if you really want to get picky, the weight) of the person needs to be taken into account. A mature male with a "stationary start, double knee bend using arms" who scores over 70 cm (about 32 inches) gets me excited about their explosiveness. If he scores over 80 cm (about 36 inches) he should be playing a vertical displacement game (like basketball or volleyball) at the highest level! The counter-jump (CJ) version of the vertical jump is one of the most popular universal sporting assessors for explosive power and is generally considered reasonably correlated with fiber type.

There's no shortage of devices on the market to assess vertical jump. On one end of the spectrum you have electronic timing plates that give digital readouts, and on the other end you have the old standby, the vertec. But here's a test you can do with no equipment: First, go through normal pre-training warm up procedures. Then, find a smooth, firm wall. Stand next to the wall (so that one shoulder is touching the wall) and raise up the hand closest to the wall. You don't need to reach as high as you can — just hold your arm up parallel and in contact with the wall. Have someone draw a line at your finger tips.

Now measure from the floor to this line. This is your "base." Now place chalk powder or something similar like the orange dust you get from eating Cheeto's on your finger tips on your dominant hand (e.g. right handers, use right hand). Go back to the wall and assume that same next to the wall position, allowing room for you to jump vertically. Jump up as high as you can and mark the wall with the chalked fingers at the peak of your jump. You can dip at the knees as much or as little as you want, and you can swing your hands for momentum. Just make sure you take off from a stationary position (no step up for this test).

Rest at least 30 seconds between attempts and continue until improvement ceases (this reduces the learning effect). Measure the distance between the highest mark caused during the jump and the base line. This is your vertical jump!

What does the test reflect?

So can you say an "X" score in the vertical jump means an "Y" distribution of fiber type? I am reluctant to say so. Researchers have provide significant support of the relationship between fast-twitch fibers and the vertical jump:

• Bosco and Komi (1979) have concluded that vertical jump performance is related to the percentage of fast-twitch fibers.

• Mero, et al (1981), found a relationship between muscle-fiber characteristics, jumping abilities, and maximal running velocity in sprinters.

• Gerard, et al (1986), reported that there exists a relationship between muscle fiber composition and the ability to perform the vertical jump in swimmers.

• Melichna, et al (1990), claimed that the relationship between height of the vertical jump and the preponderance of fast-twitch muscle fiber was statistically significant.

The reason I am reluctant to draw direct parallels between the field test (the vertical jump) and your fiber type is that the vertical jump suffers some of the limitations of any strength

exercise used to predict fiber type. This includes the fact that vertical jump ability is influenced by movement background and training. I do believe it is, however, a test with a greater chance of discriminating between fast and slow-twitch fiber individuals, because it is a faster movement. And a number of authors have noted a significant relationship between fiber type and performances in power events, therefore, confirming that the athlete with the higher fast-twitch fiber component will dominate in power performances in comparison with the athlete with less fast-twitch muscle fiber (Gollnick, et al, 1972; Saltin, 1973; Thorstensson, 1976; Komi, 1979; Mero, et al, 1981; Gerard, et al, 1986; Vandewalle, et al, 1987).

But I understand you want something more than this so I'm going to provide some generalizations. These apply to physically mature males. A score over 60 cm shows higher correlation with fast-twitch fiber preponderance, and a score under 60 a higher correlation with slow-twitch fibers. So yes, if you came up with a score in the 40-cm range, you could assume you are a typical "white man can't jump" with the associated slow-twitch fiber component! But the initial score may be more a reflection of training state than genetics, so now you need to take the next step to complete your fiber-type analysis.

The next step is to assess your trainability. If you find your training response, as measured by the vertical jump, is less than stellar, you can conclude that either your training was poorly designed or it further supports the notion that your fiber type isn't predominantly fast-twitch. If you find your vertical jump increases significantly with training, you can conclude that your training was very effective and/or you have a higher component of fast-twitch fibers. What is a significant improvement? I find about 10% gain in vertical jumping height from your starting point over a 12-week training period, dedicated at improving vertical jump, is a reasonable guide. An improvement of less than 10% might raise concern about your training or suggest you possess less fast-twitch muscle than others. And an improvement of over 10% in this time frame supports your training program and/or that you are a fast-twitch fiber person.

So how should fiber type influence strength training?

If a muscle is known to be extremely high in slow-twitch makeup, such as the soleus (reported in the 80%-plus for type-I), then a literal interpretation may be to train 80% of the time with higher reps. But this approach ignores the hypertrophy potential of the fast-twitch fiber component, so I see possibilities of using relatively lower reps *more* than 20% of the time.

Another influencing factor is what's called *training age*. The less experienced trainee in general may benefit from higher reps irrespective on any assessment of their fiber type. As the trainee becomes more advanced over the years, there's the distinct possibility that they may respond to progressively lower reps. This is the fast-twitch adaptation that strength training offers.

Training goals should be an overriding influence on program design. If you're involved in a sport that requires explosive power, you'll be working on a point on the continuum closer to the speed-strength end. If your goal is predominantly hypertrophy, in the absence of function, then you will want to exploit each muscle fiber type, and the information from the field tests becomes more important. If you've developed an appreciation of the newly hip-trend of

"functional strength," you will place movement pattern rehearsal, coordination, and balance ahead of loading or hypertrophy in your training plans.

As far as "training age" is concerned, the impact is this: the lower your qualification or number of years in strength training, the higher your optimal reps will be. Conversely, the more advanced, the lower your optimal reps may be. This might be a generalization, but it's a powerful one, and needs to be considered.

Higher reps allow the beginner to rehearse the skill of the movement (i.e. develop the intermuscular coordination) and stimulate hypertrophy. Lower reps (and more time spent overloading the eccentric contraction) allow the advanced athlete to enhance their intramuscular coordination (neuromuscular strength) and exploit relative strength (optimizing strength potential in a muscle without any morphological change).

A critical point that marries the two above, is that if, for example, you're pursuing speed-strength (e.g. involved in a power sport), but have limited strength-training background, I believe that training age guidelines *override* training goals. Generally speaking, long-term speed and strength development may be optimized by recognizing the value of movement rehearsal and the correlation between muscle surface area (hypertrophy) and long-term strength and power development.

In Conclusion

So does this mean I don't support field tests using a strength-training resistance exercise? No, but what I am saying is that the results may not be as accurate as you may have been led to believe, and that there may be better tests. More importantly, don't allow the tests to influence your training any more than the equally, if not more important, considerations of training goals and training age.

Just because you may not be one of the genetically elite who are chock full of fast-twitch fibers, you can still perform well in sports and build an impressive physique. Don't let some "iffy" field test determine your training methods. Heavy, low-rep training can still be of benefit. Finally, if you must try one of these field tests, a higher velocity assessment like the vertical jump may be more accurate that than those using traditional strength training equipment.

Oh, and don't really ask a bunch of pro footballers if they're gay. Gay or straight, you're likely to end up in the garbage can bound with athletic tape and gagged with a jockstrap!

Editor's note: Ian King has just announced his new seminar schedule. For dates and locations near you, check out the Videos and Seminars section of this website.

Lessons learned

Even though you may be predominantly slow-twitch (and, by definition, find it harder to grow muscle as a result), training can influence how your muscle fibers function, regardless of type. Strength training can teach your muscles to function more fast-twitch. Therefore, it's

unwise to give a "slow-twitch" person a program that will selectively train their slow-twitch fibers.

Fast-twitch fibers are more responsive to growth from strength training, so this aspect shouldn't be ignored by prescribing predominantly high-rep routines. If a muscle, such as the soleus, is about 80% slow-twitch, then the gut reaction would be to train this muscle with high reps 80% of the time. However, this ignores the growth potential of the 20% fast-twitch muscles. Conclusion? It might be better to train the soleus in fast-twitch (low-rep) fashion more than 20% of the time.

Training "age" might be more important than fiber type. People with years of training under their belt might benefit from doing more training in the low-rep range, whereas those that have been training less than a year or two might benefit more from higher reps. Ultimately, if muscle growth is the main objective, exploiting each type of muscle fiber is probably optimal.