The Relationship of Muscular Size to Strength

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One of the persistent myths in the field of exercise concerns the relationship of muscular size to strength…and having raised the point in the preceding chapter, we will probably be well advised to put it to rest immediately.

Which may not be so easy…simply because many people have such strong beliefs on the subject, and not without what appear to be good cause for such beliefs.

Which is certainly NOT intended to imply that there is, in fact, any slightest reason for any doubt on the subject; the facts are simply beyond dispute…a muscle, any muscle, is strong in direct proportion to its size. This is a well established point in physiology…a simple physical fact.

Even if, as happens to be the case, not a well known fact.

But enormous confusion has resulted on this score because a great number of factors besides actual muscular "strength" are involved in "demonstrations of strength" or "tests of strength". Secondly…it is very difficult to measure the actual size of a muscle, and this adds even more confusion to the subject.

SO…if we have no practical means of testing actual "strength"…and if we also have no accurate method of measuring actual muscular size…then just how do we propose to compare them? When we are not sure of either. When both are in doubt.

No wonder the subject is confused.

But, as long as such confusion lingers in your mind…you may be denying yourself some of the real value of exercise.

Let's take the matter of leverage first. Or, rather…one of the factors of leverage, since there are several.

If a man with very long forearm performs a barbell curl with 100 pounds he may raise the weight a distance of 3 feet…and if so, he has performed a total of 300 "foot-pounds" of work in that one repetition (movement).

But if a man with much shorter arms curls the same 100 pounds, he may raise the weight a distance of only 2 feet…and thus he performed only 200 "foot-pounds" of work.

The weight was the same, the movement (or exercise) was apparently the same…but the amount of work performed was certainly not the same. The longer-armed man performed 50% more work than the shorter-armed man…and burned 50% more calories, and produced 50% more heat, and required a 50% greater oxygen increase.

Obviously, then, the exercise was not the same in both cases…or, at least, the load imposed to the two men was not the same.

If the speed of movement was exactly the same in both cases…that is to say, if the curl was completed in exactly one second (for example) in both cases…then the longer-armed man was also producing exactly 50% more power than the other man.

And if the distance from the axis of rotation (the elbow) to the center of the bar was compared…18 inches to 12 inches…it would be obvious that the longer-armed man was also producing 50% more torque.

YET…if the curl was accepted as a "test of strength", then it would appear that the two man were equally strong.

BUT…of the test was conducted in such a fashion that all the above factors were allowed for, then it would be obvious that the longer-armed man was 50% stronger.

If, for example, the longer-armed man had the bar tied to the top side of his forearms (the "top" side during a curl) at such a point that the center of the bar was exactly 12 inches away from his elbow axis…thus making this distance exactly equal to the distance from the shorter-armed man's elbow to the bar when doing a curl…then the test would be valid. At least in relation to the matter of leverage.

And if this was done, then the longer-armed man would be able to curl 150 pounds with EXACTLY THE SAME EASE that he previously curled 100 pounds. Clearly providing the he was, in fact, 50% stronger than the other man.

Or, at least…he would thus prove that could demonstrate a 50% higher level of strength.

But this would still not prove that his muscles were stronger than the other man's…such proof would be lacking a number of reasons.

For one thing, recent research has clearly indicated that some men can activate a far greater than average percentage of their muscular mass in a single, maximum attempt.

In fact, it may eventually be shown that some super athletes, when compared to equal sized but neurologically inferior men, can demonstrate the ability to activate five times as much of their muscle mass.

With the clear understanding that the following figures (percentages) are not intended to be accurate, but serve merely as examples, let me attempt to make the above point a bit easier to understand.

To begin with, it should be understood that NOBODY, under any circumstances short of electrocution, can activate 100% of the mass of any muscle. When you are trying as hard as possible, even under emergency circumstances, you are using only a rather small part of any particular muscle at a given instant in time.

Under “normal” circumstances, you involve an even lower percentage of the muscle in a maximum effort…but you never involve it all.

Let us assume for this example that you can involve 30% of your muscular mass in a maximum attempt, and let us call that an “average” neurological ability.

Your identical twin, if he was neurologically superior, might be able to activate 40% of his muscular mass under similar circumstances, and this would make him a third “stronger” than you.

Or, if he was a neurological superman, as many super athletes obviously are, then he might be able to activate 50% of his muscular mass…in which case he would be two-thirds “stronger” than you.

But if he was neurologically “below average”, then he might be able to activate only 20% of his muscular mass…and he would thus be weaker.

Or…if he was “neurologically inferior”, then he might be able to activate only 10% of his muscular mass.

BUT…in all cases, the actual “strength” of muscle would be exactly the same. Even though the super athlete was involving five times as much muscular mass as the neurologically inferior man.

In all five cases, the size of the muscle would be the same…and thus the actual muscular “strength” would be the same. If all five men were wired up in such a way that their entire muscular mass could be electrically activated into a truly 100% maximum effort…then the output force would be the same in all cases.

So, these neurological differences being as great as they are…we are again faced with a factor that makes comparison of strength to size very difficult, and lends confusion to the subject.

But it should be understood that any one of the above five examples of men ranging from the neurologically inferior to the super athlete could increase his muscular size, and thus increase his strength, by exercise.

Exercise will NOT improve the neurological factors…so the inferior man might well produce literally huge muscles and still be weaker than the super athlete. But he would be stronger than he was at a smaller muscular size.

And, because of genetic neurological superiority, the super athlete may be able to demonstrate great strength in spite of the fact that his muscular size is only average. But gain…he too will be stronger if he increases his muscular size.

Thus we see examples of men with huge muscles and very little ability to demonstrate strength…and opposite examples of men with very little muscular mass but great strength.

And for that very reason, great confusion exists regarding the relationship of muscular size to strength.

And also for that very reason, it is sometimes very difficult to convince the super athlete of the value of exercise. Because his inborn neurological superiority makes him "naturally" stronger than most men of his size…he jumps to the conclusion that larger muscles are of no use to him. Or he may even sincerely believe that larger muscles would hinder his performance in some fashion.

And, in any case, he is already stronger than almost everybody else…even without exercise. So why should he bother?

But a man with such natural advantages can profit from exercise to exactly the same degree that anybody else can…and if he can be induced to build his muscles to their maximum level of size, and thus to their maximum level of strength, then he will almost literally be a superman.
So if you with to increase your strength…then build your muscles as large you can. Having done so, you may not be as strong as another man with small muscles…but you will be as strong as you, as an individual, can get.

Dick Butkus of the Chicago Bears spent several days training under my supervision in Colorado, during the previously mentioned Colorado Experiment…and afterwards, trained in our Florida facility for a period of several weeks.

Dick had never previously done any sort of systematic exercise…during eight years of professional football, his exercise had consisted of running and football drills, with a few days practice of the bench-press prior to each year's "strength test".

Yet, when I first started training him in the Summer of 1973, it was immediately obvious that Dick is a very strong man, far stronger than many men who have trained heavily and regularly for years.

Although I had no way to test his neurological efficiency, it is almost certain that it is far above average. But some his other "natural advantages" are obvious at a glance…(1) he is tall, but not too tall…(2)…for his height, he has a long torso and short legs…(3) his hips are wider than average. All of which bodily proportions offer enormous advantages for strength, because they improve some of the leverage factors.

Upon looking at him for the first time, I remarked…"If I was going to design a man to fill his slot in football, the result would be little if any different from the real Dick Butkus."

But he could have been better. A proper program of heavy exercise could have given him far better "fatty tissue to muscular mass" ratio…making him stronger, faster, and far less likely to suffer injury. And without changing his bodyweight.

Even a few weeks of very hard but very brief training produced significant increases in his strength, enormously increased his flexibility, and helped his speed.

Less than a month ago, Dick signed a five year “no cut” contract with the Bears…but a few months earlier, the rumors were flying throughout the rather limited circle of professional football to the effect that he was through, physically unable to play. Football is a dangerous sport…Dick could be seriously injured in the next game, but when he reported to camp this summer, he was ready to play.

No amount of strength is absolute protection against injury…but a stronger man always has the edge, is less likely to be hurt in any given situation.

Mike Reed of the Cincinnati Bengals is another example of a man who never trained for strength…until recently. During his first two years with the Bengals, he missed nine games because of knee injuries; he was out during four games one season und missed five games during the other season.

But last year, following a few months of hard training, Mike played every game…with no knee problems.

In Mike’s case, a program of heavy exercise reduced his bodyweight by nearly twenty pounds…while greatly increasing his muscular mass and strength, and with a marked increase in speed. Before training, Mike was carrying excess fatty tissue…which contributed nothing but extra weight. Removing a total of perhaps 50 pounds of fat, and replacing perhaps 30 pounds of it with muscular tissue resulted in a 20-pound bodyweight loss, but an enormous improvement in performance.

But sometimes the situation is almost exactly opposite. In the spring of 1973, the Buffalo Bills sent Lou Ross to us for a three month training program; at a height of 6 feet 7 inches, he weighed just over 240 pounds, far too light.

Two months later, he had added approximately 15 pounds of bodyweight, perhaps 40 pounds of muscular tissue (having burned of 25 pounds of fat, having replaced it with an equal weight of muscular mass, and having added an additional 15 pounds of muscular tissue)…and had enormously increased his strength.

Mike Reed improved by losing weight…Lou Ross improved by adding weight. But both men reduced fatty tissue and added muscular mass. In Lou’s case we have some exact figures on his performance improvements…in two months, while increasing his bodyweight by approximately 15 pounds, he added 5½ inches to his high jump, and reduced his time in the 40 yard dash by two-tenths of a second.

Lou was tested by the Bills before they sent him to Florida, and then tested by them again after two months of training under our direct supervision…and the Bills coaching staff is the source of the above figures.

Having been tested at the end of the first two months of training, Lou returned to Florida for another month of training…and he continued to improve rapidly, but I don’t yet have his final figures for the entire three months of training.

Individual athletes are just that, “individuals”…and with individual requirements, individual potential; but any athlete can improve in any sport as a direct result of exercise. And where increased strength is a requirement, this means adding muscular mass…which may or may not mean additional bodyweight. This being primarily determined by the starting level of fatty tissue.