

Nautilus
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Articles

The AE Factor

The relationship between strength and anaerobic endurance

The two charts shown on the third page presents a dramatic example of a factor that has been the subject of enormous controversy for a period of several years... the AE Factor, AE for anaerobic endurance.

Some subjects display an enormous amount of anaerobic endurance... others have almost none. Up to May 30, 1986, we have conducted this type of test on a total of approximately eleven-hundred subjects... and to say that the results of these tests have been stunning would be a gross understatement.

We are dealing here with measurement of the 'effect' of exercise, the immediate consequence of exercise... not the 'results' of exercise, the eventual consequence of exercise; rather, the immediate loss of strength that is produced when a subject is worked to a point of momentary muscular failure, to a point where continued movement against the selected level of resistance has become momentarily impossible.

We are thus conducting measurements to determine the individual's relationship between his maximum strength and his anaerobic endurance. This relationship varies enormously from one individual to another... it is almost certainly genetically determined, and it does not appear to be subject to training. You are probably born with a certain ratio, and you will probably die with the same ratio.

But if that is true, why worry about it. Why worry about something that you cannot change? Because... this one factor can be the only difference between a champion and an outright failure, everything else being equal.

Because, secondly... a knowledge of this factor, and how you measure up, can tell you the sort of activity that you just might be very good at, and the areas in which you will certainly fail. And, because, thirdly... an awareness of your own ratio will tell you how to exercise for good results, and what you must avoid.

Some subjects require exercise involving very high repetitions... for them, low- to medium-repetition exercise as it is now performed by most people is probably a waste of time, producing little or nothing in the way of benefit at best. Such exercise will probably not hurt them, but it will not help them much either... they are simply wasting their time and effort. They need very high repetitions.

Some other subjects literally cannot tolerate high-repetition exercise... for them, such exercise is utterly devastating; trained with high repetitions, such subjects will rapidly lose both strength and muscular size. These subjects need a style of training that would be worthless for many other people... but a style that is an absolute requirement for them.

I have been aware of this factor, the AE Factor, for more than fifty years, and published articles on the subject more than twenty-five years ago... but only around 1986 did I finally become aware of the real importance of this factor.

For several years now, a rather hot debate has been waged on this subject by a number of people... with little or nothing in the way of agreement, understanding or proof; but now we have proof... now we can measure this factor with a very high degree of accuracy.

Fifty years ago, I assumed that individual differences in regard to this factor were a result of individual differences in the nervous system... I assumed that some people could recruit a higher than average percentage of their total number of muscular fibers during a maximum-possible effort; such people would be far stronger than they appeared to be, but would have very little anaerobic endurance.

Up to 1986 there was a lot of speculation on the subject of different types of muscle fibers... but not by me; I knew very little about different types of muscle fibers, and claimed to know even less... because I try to avoid forming even opinions until and unless I have some reliable method of confirming them.

So we knew what we were measuring here, at least in a sense.. but we did not even claim to know just what was responsible for the factor that we were measuring. Perhaps we had discovered a very accurate, non-invasive method of

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determining fiber types, perhaps... and perhaps not. Maybe we have discovered a method of measuring the factor that I once called neurological ability... and maybe not.

And maybe we had discovered a way to measure some combination of these factors, or maybe we had found a way to measure some unsuspected factor that nobody ever ever dreamed of.

We didn't know, and we didn't claim to know... but we did know the importance of this factor, whatever it turned out to be. I will remind you that nobody in their right mind would even attempt to explain either light or gravity... but we can measure them both, and we can take advantage of the opportunities afforded by both light and gravity, and we can avoid the problems associated with both light and gravity. And we can do so even without the slightest idea of any value on either subject.

We do not know just how widely this factor varies, from one individual to another... but we do know that the variation is wide, very wide. So far, from a fairly small sample of approximately eleven-hundred subjects, we have already measured a variation that exceeds forty to one.

Chart 1 shows a subject with enormous anaerobic endurance, while Chart 2 shows a subject with almost no anaerobic endurance. Both of these subjects were exercised in the same manner, and to the same degree... both subjects were given a level of resistance that was calculated to produce momentary muscular failure after a certain number of repetitions. An anaerobic level of resistance, high enough that they would be unable to continue after a few repetitions.

Then both subjects performed as many repetitions as possible, stopping only when it was impossible to continue, when it was no longer possible to produce movement. Both subjects were able to perform only six repetitions, and then, because of momentary fatigue, were unable to move against the selected level of resistance.

Both subjects were tested before the exercise, in order to determine their starting level of strength... and were tested again immediately after the exercise, to determine the loss of strength produced by the exercise, the 'effect' of the exercise, the immediate consequence of the exercise.

The subject in Chart 1 produced almost no effect, almost no loss in strength... the actual effect was just over one percent. Very, very little.

In startling contrast, the other subject produced an effect of 43.94%; almost forty-four percent, nearly a forty-four percent loss in strength from only six repetitions.

Chart 1

Effect produced by work to failure by a subject showing a high level of AE Factor.

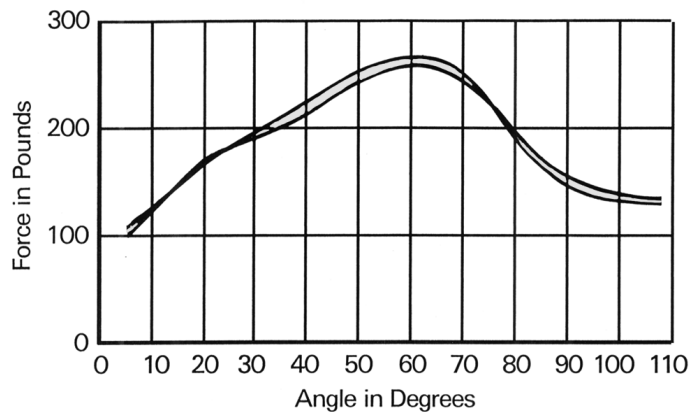
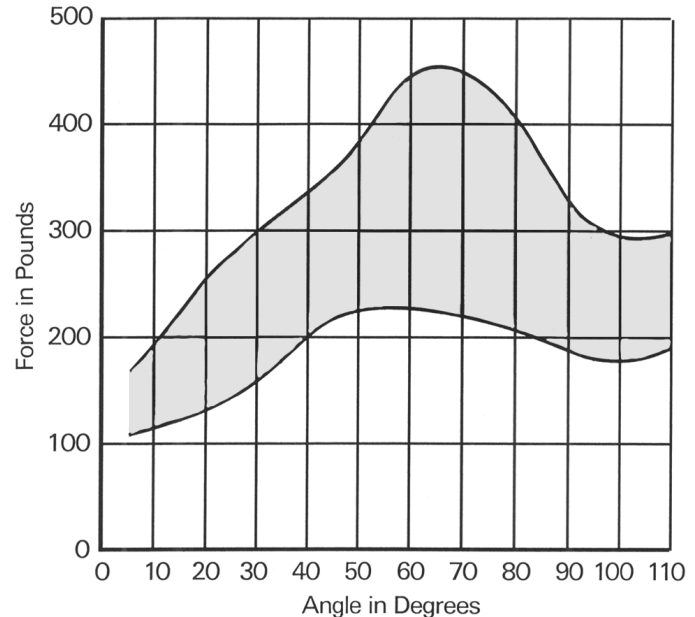


Chart 2

Effect produced by work to failure by a subject showing a low level of AE Factor.



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Chart 3

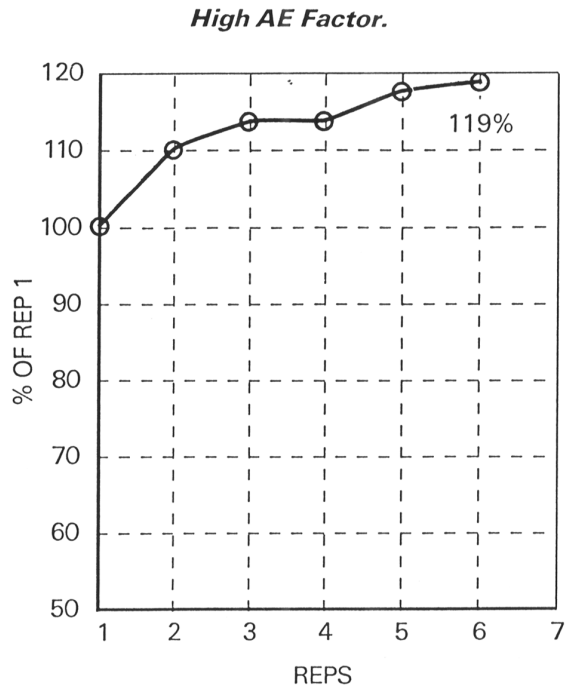
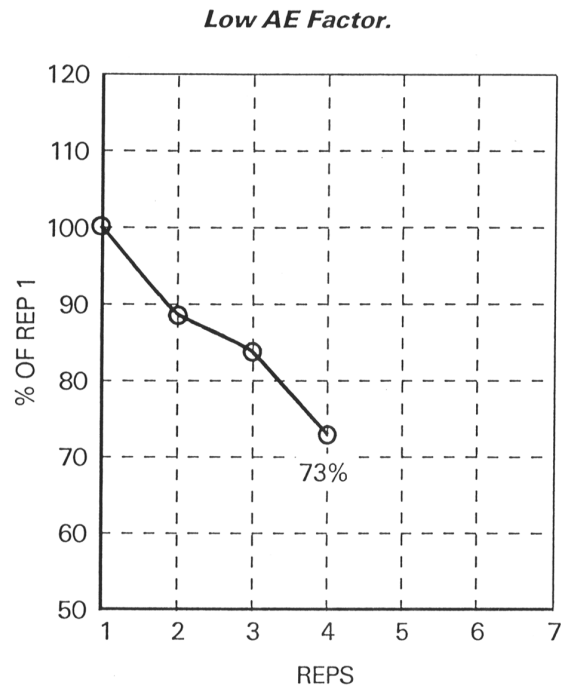


Chart 4



The second subject produced an effect that was literally more than 40 times as much as the effect produced by the first subject... and, I want to point out again that this difference does not represent the greatest possible difference; quite the contrary... we have already encountered at least one subject that demonstrated a far greater difference, a difference so great that we simply do not know how to make a meaningful comparison.

In the first two charts, the effect was produced by working against a sub-maximal level of resistance; all of the first five repetitions were sub-maximal, only the final repetition was a maximum effort... after which, the subjects could not continue.

But now, look at the next set of charts (3 and 4), a different type of chart showing a different sort of test... in these tests, every repetition was a maximum-possible effort. The subjects were producing as much force as momentarily possible during each repetitions.

The subject in Chart 3 displayed an almost unbelievable level of anaerobic endurance... instead of losing strength from one repetition to the next, he actually became stronger. During his sixth repetition he was producing nineteen percent more strength than he did in his first repetition.

In contrast, the other subject lost twelve percent of his strength from the first repetition, was unable to perform only 88 percent of his first repetition during the second repetition. His first three repetitions reduced his starting strength by 27 percent.

During these tests, the computer testing machine was programmed to continue until the strength of the subject dropped below 75 percent of his starting strength... and since the strength of the subject dropped to only 73 percent of his starting level of strength during the fourth repetition, we have no sure way of knowing just what effect would have been produced if he had continued for a total of six repetitions.

But if you continue the average line of drop in strength on this chart to a point where six repetitions would have been reached, then it appears that this subject would probably have performed at a level of approximately fifty-five percent of his starting strength level during his sixth repetition.

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This, I believe, is a reasonable assumption, even a conservative assumption, since the earlier chart demonstrated a loss in strength of nearly 44 percent that was produced by six sub-maximal repetitions... so, here, as we are dealing with harder repetitions, each one being a maximum repetition, it is reasonable to assume a loss in starting strength of forty-five percent.

But, then... just how do you compare a man who grows stronger by 19 percent to a man who loses 45 percent of his starting strength from the same type of amount of exercise? When both subjects lose, then they can be compared... and if both subjects gain, then they can be compared... but when one loses enormously while the other shows a very significant gain in strength, then I simply do not know how to compare them.

Incidentally... this subject that gained 19 percent in strength during his first six repetitions was not the same subject shown in the first set of charts. That subject, the subject that showed an effect of only one percent from six sub-maximal repetitions, when tested in the manner shown in the second set of charts, where every repetition was a maximum effort, also demonstrated an increase in strength during the first six repetitions; but gaining less than the other subject, gaining only 9 percent instead of 19 percent. And while you might wonder why a subject would show an increase in strength in one set, repetition by repetition, while working to their limit during each repetition, and then show even a slight loss of strength after performing an equal number of sub-maximal repetitions... you must remember that these tests are different in several ways, although they are both designed to measure the same factor.

In the first series of tests, where the subjects failed after six repetitions because of a loss of strength that would not permit them to continue, they were performing both the positive parts and the negative parts of the exercise, moving slowly but constantly with no time to rest.

Whereas, in the second series of tests, where some subjects grow stronger repetition by repetition, they were performing only the positive parts of the exercise... and were provided with a few seconds of rest between repetitions while the machine cycled back into position for the next repetition, and even a few seconds rest does allow a very meaningful degree of recovery between repetitions.

And there are other differences as well... in the first series of tests the work is performed in a dynamic fashion, doing both the positive and negative parts of the exercise, both lifting the weight at a steady speed and lowering the weight at a steady speed, with no rest between movements; but the testing in this case is done in a static mode, without movement... and there is a distinct difference between your level of dynamic strength, and your simultaneous level of static strength. In general, with a fresh muscle, your static level of strength is 20 percent greater than your dynamic level of positive strength.

But, in the second series of tests, both the work and testing are performed while movement is occurring, and at the same speed, simultaneously... and, as stated earlier, in this case only the positive part of the work is done, and there is some rest between repetitions.

This same machine can also be used to work and test both the positive and negative parts of the exercise, with very little rest between repetitions; and when used in that manner then a totally different result is produced, a result that is literally so dramatic that it must be experienced to be believed.

Recently, using the machine in that fashion, we worked a subject to the point that his starting level of positive strength was reduced by 97.9 percent... at the end of the test his remaining level of positive strength was only 2.1 percent of his starting level. But I would certainly not suggest that you try such a style of training; quite the contrary, since it took this subject eleven days to start feeling normal after this test, and he was probably not fully recovered even two weeks after the test. Such exercise could only have one result: a rapid loss of strength.

In contrast... another type of subject with great anaerobic endurance, performed a total of thirty-four repetitions to failure while reducing her starting strength level by less than 19 percent.

So, my point... what is good for one type of subject is terrible for another type of subject.