

# Concurrent Training for the Bodybuilder

Jacob Wilson, M.S., Ph.D candidate, CSCS, and Gabriel Wilson, M.S., CSCS

**Published:** March, 2009

The hallmark of the bodybuilding phenotype is extreme muscularity coupled together with an equally extreme absence of body fat. We institute resistance training to maximize the first goal, while inclusion of cardiovascular exercise is instituted to accomplish the latter. The combination of these training types (resistance and endurance) is known as concurrent training. Adding endurance exercise to resistance training in order to enhance fat loss is strongly supported. One study<sup>1</sup> compared 10 weeks of 3 days per week strength training only, jogging 25-40 minutes at moderate to high intensity (65-85 % heart rate max) or a combination of the two on resting metabolic rate, body fat lost and strength. While resting metabolism increased equally in the strength only and strength + endurance group, it actually declined in the endurance group, most likely due to a loss of muscle mass. Bottom line however was the finding that fat loss was greater in the group that did both (12.2 to 8.7 %) compared to strength only (15.4 % to 14 %). Unfortunately however, strength gains in maximal bench press and squat were greater when strength training alone (24 and 23%, respectively) compared with the combination group (19 and 12%, respectively). Similarly, Glowacki and colleagues<sup>2</sup> found that fat loss was greatest when combining treadmill running 2-3 times per week with weight training, but that jump power and leg extension strength were lower than when strength training alone. Finally, and most importantly, muscle fiber growth has also been blunted when adding endurance exercise to resistance training<sup>3, 4</sup>.

The question therefore, is how can we maximize the positive effects of concurrent training, while minimizing or perhaps eliminating the negative effects? Thus far, no scientists have discussed this subject as it purely relates to the bodybuilder.

As researchers who have dedicated our lives to bodybuilding we have decided to rise to the occasion and provide you with the most up to date information on concurrent training. Part I of this series will analyze mechanisms which may explain decrements seen during concurrent training; and also propose a model on the specificity of training. Part II will analyze studies which have examined concurrent training under various different scenarios. And finally, Part III will supply practical applications which will allow you to optimize your training split.

## How concurrent training is studied (outcome measures)

Generally, concurrent training studies have 3 groups: one which resistance trains only, one that endurance trains only, and finally a group which does both. Researchers then measure a number of outcomes and compare them across groups. These include:

- **Indexes of Muscle Growth** - Here researchers will first look at the entire size of the muscle (e.g. how many inches did your arms grow)<sup>5, 6</sup> or they will analyze individual muscle fiber types including slow and fast twitch fibers.<sup>4, 7</sup>

- **Strength** – Strength can be measured on free weights<sup>4, 8</sup>, but it can also be measured on machines which look at strength at both slow and fast speeds (isokinetic testing)<sup>9, 10</sup>. This is critical as strength is affected differently depending on the speed it is analyzed.
- **Power** – This is generally measured with explosive movements such as the vertical jump or bench press throws<sup>2, 4</sup>
- **Neurological Changes** – Ultimately the nervous system is responsible for 'recruiting' muscle fibers. In simple terms the nervous system stimulates a muscle to contract by sending down electrical impulses towards the muscle. Scientists can measure the ability of the nervous system to stimulate muscle by measuring its electrical activity (electromyography – emg)<sup>11</sup>.
- **Endocrine (hormonal) changes** – The two main hormones measured are testosterone which is taken as an anabolic hormone, and cortisol taken as a catabolic hormone. The ratio between the two (Testosterone:Cortisol) is measured in concurrent training studies<sup>3, 4</sup> and is thought to reflect the anabolic state of the individual.
- **Protein Synthesis and Degradation Pathways** – Unfortunately very little has been done in this area. However, we do know how the body responds to both endurance training and resistance training alone and can therefore make several scientific conclusions about the nature of these processes in combination.

### **Mechanisms which may explain muscle, strength and power decrements following concurrent training**

There are a number of explanations which may explain decrements in muscle, strength and power when adding endurance exercise to a resistance training program. These can be divided into long term or chronic mechanisms and short term or acute mechanisms. In order to understand how to avoid the negatives of concurrent training we must understand why these negatives occur. This section essentially forms the basis of this series.

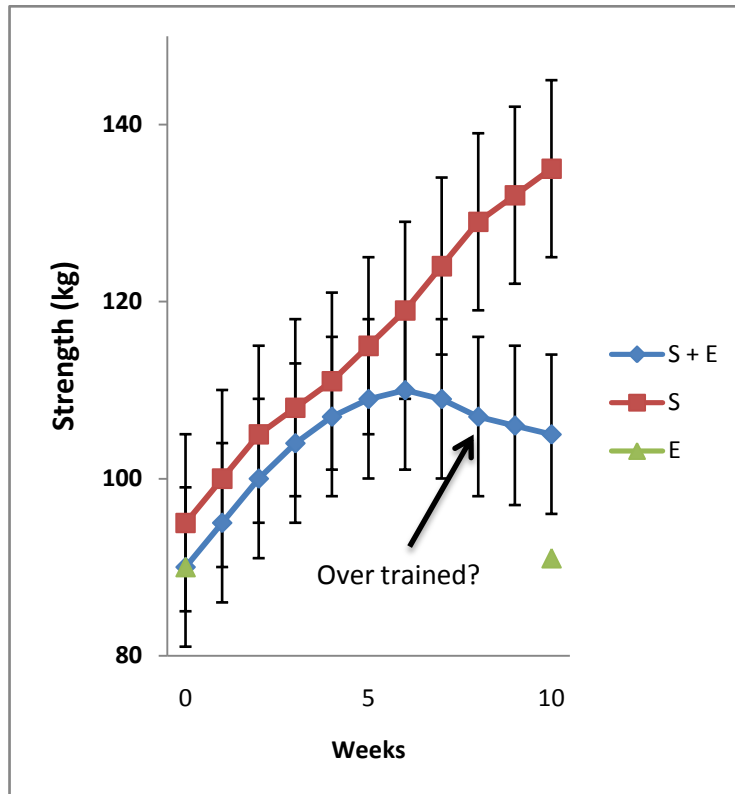
#### **Chronic (Long Term) Hypothesis**

According to the chronic hypothesis the addition of endurance exercise can impede long term adaptations by overtraining the individual; thereby, overwhelming their ability to adapt to resistance training or by producing adaptations which are conflicting with strength adaptations.

#### **Overtraining / Overreaching hypothesis**

The main point to resistance training is to stimulate the trained muscle groups to adapt by increasing their size and function. In order to adapt however, an individual must have the resources, particularly nutrients necessary to complete the process. According to overtraining explanations endurance exercise drains our resources both during the activity

itself (e.g. by using up our carbohydrate stores, and breaking down proteins) and during recovery (endurance exercise itself requires the individual to adapt and thus, is reliant on the body's adaptive resources). Overtraining most likely explains a number of the studies in the literature. For example Hickson et al.<sup>12</sup> had individuals strength train 45 minutes 5 days per week using a split training routine, while simultaneously running at maximal intensity for 30-40 minutes 6 days per week. It was interesting because strength gains, though slightly less were similar after 7 weeks (figure 1); but thereafter, the strength only group continued to improve, while the concurrent training group began to decline. The decline is extremely characteristic of overreaching.



**Figure 1.** Strength changes after 10 weeks of study. Redrawn from Hickson et al.

There are a number of factors which effect whether overtraining occurs including the type of endurance training used (cycling vs. running), the frequency of endurance training, intensity as well as a host of other factors which will be discussed throughout the series.

### Competing long term adaptations

Traditional resistance exercise trains the body in short duration activities in which force is maximal or at least near maximal levels. In contrast, endurance training requires individuals to exert relatively low force outputs and maintain those outputs over long durations. Logically, the adaptations for resistance and endurance exercise are vastly different and in many cases conflict with one another. We briefly outline these conflicting adaptations below.

## Neural adaptations

Resistance training causes the body to increase its ability to recruit muscle fibers and also increases the rate at which muscle fibers can be recruited. Moreover, it trains motor unit populations (groups of muscle fibers) to be activated in unison or synchronously so force is maximized. In contrast, endurance training causes the body to recruit small populations of motor units and also teaches the body to rotate motor units in and out (asynchronous firing) so as not to wear muscle fibers out. Overall studies seem to indicate that endurance training hinders the body's ability to rapidly recruit muscle fibers. This is thought to be the case for two reasons:

1. In general slow velocity strength is not inhibited during concurrent training<sup>10</sup>, but fast explosive type lifts are hindered<sup>9, 10</sup>, as are measures of power such as the vertical jump.
2. Studies<sup>9</sup> suggest that the ability to activate muscle tissue as measured by its electrical activity (EMG) is not hindered at slow velocity contractions or during free weight 1 repetition maximum lifts which inherently are slow. However, during fast velocity contractions EMG activity is lower.

## Hormonal Responses

As stated it is the testosterone to cortisol ratio which is taken as a measure of net catabolism in training studies. In general endurance exercise does not lower testosterone in concurrent training studies, but it does increase cortisol<sup>2, 4</sup>. Cortisol increases in response to a depletion of resources such as intramuscular carbohydrate (e.g. glycogen) stores or low levels of blood glucose. Thus, it is likely that endurance training increases cortisol due to its general ability to lower the body's energy stores, making us even more prone to concurrent training's effects under dieting and particularly low carbohydrate settings. Cortisol changes are intensity and duration dependent. In terms of intensity, cortisol does not appear to increase until 50-70 % of an individual's maximal aerobic capacity (60 % heart rate max) increasing thereafter in a dose and duration dependent manner. Thus, low intensity cardio is less susceptible to increases in cortisol. Except when blood glucose is low; in which case, low intensity exercise also increases cortisol.

## Muscle fiber Growth

As stated, endurance training has been shown to decrease muscle fiber growth. For example, Kraemer and colleagues found that strength training was able to increase growth in slow twitch type I fibers and in both fast twitch fibers measured (type IIA and IIC). In contrast, those who concurrent trained only increased the size of type IIA muscle fibers. Two reasons for this are overtraining, or possibly counter adaptations as endurance exercise activates pathways which cause muscle tissue breakdown. The latter action makes sense as a smaller amount of muscle tissue eases the job of the heart and lungs in having to oxygenate the working musculature.

## Acute Hypothesis

- A. Lowered capacity to lift large loads

According to the acute hypothesis lingering fatigue from endurance training hampers the short term ability of individuals to lift heavy weights. If an athlete cannot lift maximal loads they will predictably experience submaximal adaptations. This hypothesis is supported by a study which found both interval (6, 3 minute cycling bouts) and long duration continuous moderate intensity cycling (50 min, 70 % VO<sub>2</sub>max) lowered repetitions performed in leg press at 4 (25 %)- and 8-hour (9%) conditions, but not at 24 hours. These results are consistent across studies<sup>13, 14</sup>

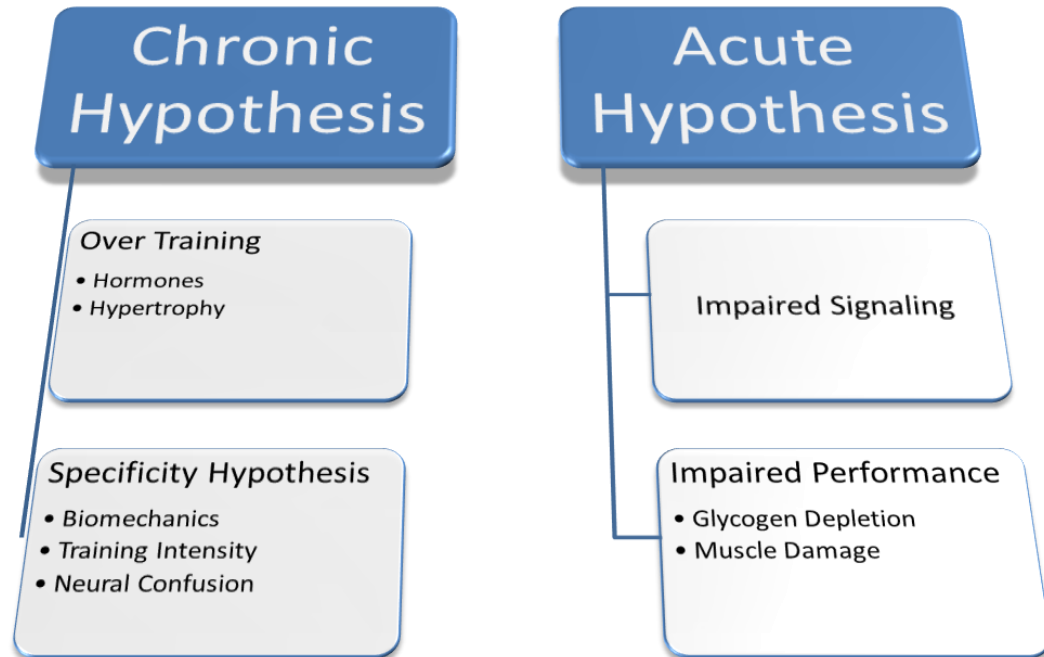
#### **B. Impaired signaling**

Endurance training, particularly at escalating intensities may deplete muscle glycogen levels (carb stores). This is important as a very recent study found that resistance training in a low muscle glycogen state actually impaired AKT signaling which is a potent signaling pathway responsible for activating protein synthesis following high mechanical loads<sup>15</sup>. Therefore, intense cardio performed particularly on the same day as resistance exercise would be predicted to lower muscle glycogen and impair performance. Moreover, another recent study by Ruse and colleagues<sup>16</sup> found that moderate intensity (67 % VO<sub>2</sub> peak) cycling immediately acts to inhibit important elongation factors (eef2) responsible for increasing protein synthesis and maintains this inhibition for the duration of the activity. Resistance training increases protein synthesis, and therefore, cardiovascular exercise performed during this window of time would be expected to interfere with the process.

#### **Specificity of Training Conditions**

From extensive analysis of the literature and our academic background in the [specificity](#) of training we put forth that the greater the differences are in aerobic training relative to strength training, the greater the interference effects will be in concurrent training. It is important to understand that differences are dependent on the intensity, and biomechanics of the activities performed. This is our current model and will be used throughout the remainder of the series to explain differing outcomes experienced across concurrent training studies.

## Conclusion



### Figure 2. Concurrent Training Model

Figure 2 summarizes our proposed model for explaining deficits seen when combining endurance and strength training in a program (concurrent training). Chronically, athletes may experience overtraining, which may result in a decrease in the testosterone : cortisol ratio, as well as decrements in muscle hypertrophy. If the training intensity and biomechanics are dissimilar, the athlete may experience neurological confusion.

Acutely, training for endurance in close proximity to weights may increase muscle damage and deplete glycogen; which would subsequently decrease performance, and impair anabolic signaling such as AKT signaling.

Part II of this series will investigate studies which have examined concurrent training under a number of different scenarios. Our explanations for these results will constantly refer back to this model; therefore, it should be well understood before proceeding to part II.

Keep it Hard-core

Jacob Wilson – [jwilson@abcbodybuilding.com](mailto:jwilson@abcbodybuilding.com)

Gabriel Wilson – [venom@abcbodybuilding.com](mailto:venom@abcbodybuilding.com)