

Understanding overtraining and fatigue

Many bodybuilders and other athletes fail to appreciate the significance of the fact that muscles grow and become stronger only during rest and recovery. In order to improve your gains, while reducing the risk of overtraining, which includes injuries, loss of size and strength, irritability and depression, it's important to understand what fatigue is, how to assess and monitor it, how to delay and combat it, and why and how to use various products and techniques to hasten your recuperation.

You grind out what you planned as your last set of the day. You are tired, of course, but your motivation to add mass constantly makes you ask yourself if you have done enough. Nobody seems to be able to tell you how tired you should be at the end of your training. You want to be ensuring that you have stimulated growth so you decide to do one more set, and end up injuring yourself due to the lack of concentration and/or poor form resulting from mental as well as physical fatigue.

Perhaps you have just completed your 12th set of biceps work. Your arms are burning and aching with that deep fatigue that comes from using heavy weights. But the question remains – will another set or two mean an extra inch on your arms by the end of this training cycle? Therefore, should you include some reverse or hammer curls? Or maybe some heavy eccentric close-grip chins?

The question that plagues every bodybuilder are, how much and how hard to train; and when to stop. If a little training is good, how much more is better? More importantly, how much is enough to produce the best gains?

Answers to these questions begin with an understanding of the processes that underline that feeling of partially or totally trashed after your workout.

WHAT IS FATIGUE?

Scientists define fatigue as a failure to maintain a specific force or power output. The purpose of fatigue is to protect the individual muscles and the body from serious damage, which extremely motivated persons, might be able to inflict on themselves.

Basically, fatigue is a subjective sensation that reflects various metabolic, circulatory, nervous or other physical and physiological changes induced by stress of all kinds. The bottom line for bodybuilders and other athletes is that endurance drops and you get weaker, mentally as well as physically.

As far as physiology goes, a number of processes are involved in the development of and recovery from weight-training-induced fatigue.

The causes, consequences and duration of fatigue effects differ based on different types of training stresses – high reps, low reps, twice-a-day training, continuous tension verses relaxation, pauses between reps, 30-second rest periods, 90-second rest periods, three to four minute rest periods between sets, tec. We will focus on four main interrelated factors that can lead to immediate reductions in work capacity.

1) Accumulation of Substances.

These include mainly waste products (lactic, pyruvic and succinic acids, ammonia and urea), but also heat and, when the exercise or stress is particularly intense or prolonged, catabolic hormones such as cortisol.

2) Depletion of Substances.

This involves energy sources (high energy phosphate compounds, particularly creatine phosphate and possibly glycogen), some key minerals/electrolytes (particularly potassium), chemicals that transmit messages between nerve cells in the brain (that influence hormone levels, mood, strength capacity, etc).

3) Changes in the physical-Chemical State of the Muscle.

These include structural changes in the permeability of the membranes surrounding each muscle fibre, changes in their excitation threshold, changes in the levels of phospholipids, (choline, inositol), nucleic acids, ribonucleic acid (RNA), many enzymes, and even in the colloidal structure of the cells.

4) Disturbance of Regulation and Co-ordination in the Nervous System.

These changes are known to affect both brain and peripheral nerve function.

Although all of the above factors can and do play roles in fatigue of various types, the most important in the loss of work capacity associated with bodybuilding and strength training are the accumulation and depletion of substances.

ACCUMULATION EFFECTS

The longer each set lasts and the shorter the rest periods between sets, the greater the tension in the muscle. The greater the number of sets the more waste products accumulate. As the by-products of anaerobic metabolism, particularly lactic acid, accumulate they inhibit both the production of energy and the coupling and uncoupling between myofilaments that result in tension development (contraction) and relaxation of the muscle.

Intense and prolonged exercise also results in the release of ammonia from muscle, especially from the larger, stronger fast twitch fibres. Ammonia does not only inhibit muscle metabolism; its most important effects are on the brain, where unlike lactic acid, it can alter the concentration of neuro-transmitter and reduce the level of adenosine triphosphate (ATP).

Training itself, particularly multiple sets lasting 45 – 60 seconds each, will, over time, increase the blood supply to the muscle and the activities of certain enzymes (such as lactate dehydrogenase) which enable the muscle to combat and withstand the acidic conditions produced by such stresses.

Relaxation pauses between reps and longer rest periods between sets can help, as can breathing exercises and meditation (yes! calm down between sets; attempting to stay superpsyched throughout your entire workouts is usually counterproductive and can quickly lead to overtraining). Flexing the muscle (to squeeze out the waste products), stretching (to facilitate relaxation of the muscle and increase blood flow) and relaxing the muscle between sets, exercises and training sessions are active ways to promote recovery. Very low-intensity 'aerobic' work (on a lower body or upper body cycle ergometer, for example) can also dramatically reduce and eliminate the waste products of high-intensity exercise. Passive techniques might include massage and vibration therapy.

Keep in mind, though, that in order to fully increase all the components of a muscle, you must expose it to concentrations of waste products. But using the methods above will be particularly beneficial in the development of strength and power. However, maximal muscle size can only be developed by regular exposure but no over-exposure to supramaximal levels of these substances.

Nutritional methods might include ingestion of sodium bicarbonate to buffer the acids generated by intense anaerobic work. Consumption of branched chain amino acids can help maintain an amino acid balance in the bloodstream that staves off fatigue (by preventing an increased uptake of tryptophan by the brain and a resulting increase of serotonin, which typically produces feelings of fatigue and sleepiness). Carnitine supplementation is another potential recovery factor because it promotes energy production (energy is needed to rebuild and replenish each cell) by esterifying free fatty acids and facilitating their transport into the mitochondria (where most fuel from foods is converted into usable energy).

DEPLETION EFFECTS

Depletion typically refers to the reduction of fuels such as glycogen for exercise. However, under conditions other than a very low or zero-carbohydrate diet, the supply of muscle glycogen has never been shown to be a limited factor in resistive exercise.

The loss of energy results, rather, from the fact the high acidity in the muscle, along with the ammonia, interferes with the breakdown of glycogen to produce adenosine phosphate (CP). Since large quantities of these high-energy phosphate are used rapidly during high-intensity exercise, the failure to keep these replenished leads to a rapid loss of capacity.

Ingestion of inosine has been suggested by some athletes as a potential means to facilitate replenishment of these critical compounds, although this has not been scientifically studied.

Another sign of fatigue, in the fact the first that can be measured in the blood, is the element potassium, which leaks out of the muscle fibres as a result of repeated stimulation/contraction. Potassium is the most important positively charged ion within the cells. It has a key role in fatigue because it maintains the integrity and excitability of the cell membranes and thus the responsiveness, contractile capabilities and endurance of the muscle cells themselves. When bonded to certain amino acids such as aspartic acid, which serve to carry certain electrolytes into muscle cells, intracellular potassium in muscle can be significantly increased, helping to maintain strength and endurance under conditions of repeated intense contractions.

Most people don't realise how much water they lose through sweat and metabolism. Keeping adequately hydrated by drinking about 475mls of a diluted liquid or water 45 minutes or so before your training and frequently drinking small amounts as you workout progresses is critical. It will maintain your plasma volume, dilute the wastes generated by muscular contractions, promote the greatest pump and keep you cool – that's just the start. Be sure to drink plenty of fluids after your workout as well.

WHAT ABOUT REALLY HEAVY TRAINING?

Lower reps and sets produce different effects. There is little accumulation of waste products (or depletion of energy or other substances). The principal effects seem to be of the sarcomere – the basic unit of contraction in the muscle fibres. There is also a disruption of the membrane system within the muscle cells on which protein synthesis takes place and within is contained the calcium that controls the process of contraction and relaxation. These effects lead to an early failure of the contractile mechanism. The loss of force-generating capability tend to be prolonged and the recovery period slower than for less intense (lower percentage of maximum) work.

Although you now know a little about fatigue, you still don't know how tired you should be at the end of a workout if, say, you're scheduled to train the next two days in a row. How do you know how tired you really are? How do you know if it's the training or other stresses in your life, that are draining you the most? First, take a long, hard and honest look at your life and at the stresses other than training that compete for your recuperative energies.

RATE YOUR EMOTIONAL STATE

Elements to evaluate:

- Workout quality
- State of relaxation
- Anxiety level
- Energy level
- Level of optimism
- Training effort
- Enjoyment of life/training
- Alertness
- Confidence
- Ability to concentrate
- Instinctive (vs. Analytical) responses to life/training
- Feelings of control over life and training

Awareness training is an important step towards controlling your mental state, recuperation rate and life in general. There is a critical relationship between the mind and body that will become evident if you make a concerted effort to see it. A training log is one way that can help you see this relationship. You can and should write down what you think about the quality of your workout and next to it write down how you feel using the above items as your guide. More than a couple of consecutive workouts with poor ratings suggests that you might be overstressed (from training and/or other life situations) and should consider both your revising your training and increasing your efforts to recuperate.

Awareness training involves more than attuning yourself to your emotional state before, during and after a set or workout. It involves identifying and, ultimately, doing something about negative forces in your life.

Military researches have concluded that in sustained high-intensity combat operations, the psychological (rather than the physical) component will be the limiting factor and the first to succumb to the efforts of stress.

Recuperation thus involves the recovery of both the psychological willingness and motivation as well as the psychological ability to perform work. Sometimes reduced training efforts and active rest are necessary for the psychological/neurochemical restoration. This reduction of training, unfortunately, is one of the difficult things that bodybuilders and other athletes must deal with if they wish to maximise their potential.

RECOVERY TIME

Some variables that can affect recovery time

- 1) Larger muscles tend to take longer to recover than smaller muscles.
- 2) Fast-twitch muscle fibres do take longer to recover than slow-twitch muscle fibres.
- 3) Higher intensity effort- % of one rep max (1MR) and eccentric exercises do require longer periods of recuperation.
- 4) Older individuals do require more time to recuperate from the same amount and level of effort than younger athletes.
- 5) Stress, poor diet, recreational drugs and less than optimal health will increase recovery time.

SYMPTOMS OF OVERTRAINING

Two different types of physical overtraining can be distinguished: one type is more common in older athletes, highly advanced athletes, and those who impose extremely high levels of physical stress upon themselves. The symptoms of this type of overtraining are often subtle and hard to diagnose.

They may include the following:

- Slight feeling of fatigue/overtiredness
- No change in sleep requirements
- Loss of appetite without appreciable change in bodyweight
- Lower resting pulse
- Lower resting systolic blood pressure
- Abnormal post-stress/workout elevation of diastolic blood pressure
- No change in basal metabolic rate (BMR) or body temperature
- No obvious psychological manifestations

The other type of overtraining seems to occur more among younger, less experienced athletes involved in explosive and strength sports including sprinting, jumping, weightlifting and power lifting. The symptoms tend to be more evident, and may include the following:

- Persistent fatigue
- Increased sleep requirements
- Reduced appetite usually accompanied by weight loss
- Increased resting pulse
- Normal to slightly increased body temperature
- Increased blood pressure, particularly systolic pressure
- Slower (impaired) reaction time
- More frequent headaches
- Reduced ability to perform skilled movements