Austin Sports Medicine

Open Access

Austin Publishing Group

Review Article

Education of Healthy Training Throughout the Supercompensation Phenomenon

Ewa Szczepanowska*
Department of Sports Medicine, University of Szczecin, Poland

***Corresponding author:** Ewa Szczepanowska, Department of Sports Medicine and Associate Professor of Exercise Physiology, University of Szczecin, Faculty of Geosciences, ul Mickiewicza 16, 70-383 Szczecin, Poland

Received: September 05, 2019; **Accepted:** October 04, 2019; **Published:** October 11, 2019

Supercompensation as a Phenomenon

Living beings have a gift-it is called regeneration. Humans have a considerable regeneration capacity. From this viewpoint, a workout can be considered as controlled bodily harm and "post-training regeneration" is not different from the scratched-skin healing process.

Physical activity, also called physical stress, disturbs visceral organism equilibrium (homeostasis). There is depletion of energy resources such as glycogen supported by working enzymes, hormones, or oxygen from red blood cells. There is physical damage such as micro-ruptures of muscle fibers, initiation of muscle, tendon and joint inflammation etc. This represents the first stage of the whole training process to increase a level of performance. The most effective in this phenomenon is a mix of active regeneration and invasive recovering procedures. During the rest stage, the human body is experiencing the process called adaptation, the process in which the organism prepares for a new experience (and for a new stress). With adequate earlier training, adaptation embraces glycogen restoration and increase of enzyme activity and hormone redistribution (some are inhibited, some excreted) and, in the longer term, muscle mass growth, enhanced muscular innervation, blood vessel multiplication, or blood volume increase including red cell multiplication. Further there is an improvement of oxygen utilization as well as its economy, both enhancing respiratory capacity; next is cardiac hypertrophy increasing cardiac capacity; and, specifically in youth, there is bone growth stimulation and bone density increase.

One should also not overlook adaptation at the psychological level such as improved tolerance of physical pain and of psychological stress, and enhanced self-control and willpower. The body remembers the last stress with which it battled. Not only does it compensate and return to its original state but it overloads to a higher level: the body supercompensates.

The following chart shows that individual recovery processes may take from a couple of minutes to many hours, even days.

Necessary recovery time for chosen biological parameters [1].

This information raises a simple question: How much time it will take to complete one supercompensation cycle? But the answer is unclear. One thing is sure: time of recovery is always longer than time of exercise. What is known exactly is the training time. At the one end, if the physical stress is concentrated in a couple of seconds (e.g. one sprint interval), than the recovery time is counted in minutes. In this case one can set as many repetitions as he will be able to recover within the selected time frame. At the other end, a sustained workout may take a couple of hours, and the recovery time may take more than one full day of energy restoration. Moreover, the supercompensation cycle can be composed of a mixture of daily or weekly training sessions where the regeneration process will count weeks even months. Generally the training program is a chain of supercompensation cycles. The secret of correct training is allowing the correct length of recovery time between workouts. Looking at the supercompensation graph, the best time to start the next workout is while performance is achieving the top of the curve or slightly after.

Appropriate supercompensation cycle repetition leads to a performance improvement. Conversely, if subsequent workouts start before supercompensation occurs, then the insufficient recovery will lead the subject to fatigue accumulation, overreaching and finally to overtraining.

Definition of Supercompensation Training

The body is always seeking to maintain a state of homeostasis so it will constantly adapt to the stress from its environment. Training is simply the manipulation of the application of stress and the body's subsequent adaptation to that stress to maintain homeostasis. The adaptation that occurs is fairly predictable. In training the desired adaptive response is called supercompensation. The supercompensation model is still the most straightforward representation of the training process. The body is essentially rebounding from the low point of greatest fatigue. This supercompensation effect is not only a physiological response but also a psychological and technical response. Different physical qualities respond at different rates, so it is misleading to think that there is one generalized supercompensation curve. Essentially each physical quality has its own individual supercompensation curve. These differences in timing for supercompensation are due to the duration of the various biological regeneration processes that take place during the recovery phase. For example: the replenishment of creatine phosphate will take only a few seconds to a couple of minutes to return to normal levels, also one of the shortest recovery processes occurs in muscles-lactic acid removal-and lasts just a few minutes but the glycogen-reloading (restoration) process in the muscle, the main aerobic energy resource, may last 24 hours; in some cases, it may last even longer, can extend the time of compensation (and then supercompensation) up to a couple of days. The production of new enzymes (proteins) may also take hours, sometimes even days, to complete. Other biological parameters show significantly longer recovery times.

In supercompensation the subject can handle the same training load or a greater load with ease in the subsequent workouts if recovery

Citation: Szczepanowska E. Education of Healthy Training Throughout the Supercompensation Phenomenon. Austin Sports Med. 2019; 4(1): 1029.

is adequate and the new stress is timed properly.

This adaptive phenomenon is an ongoing wavelike process. If all the variables are manipulated correctly and the proper ratio of work to recovery is achieved, the result is a continually rising sinusoidal curve pointed toward higher-level performance. To ensure supercompensation, the subject must be healthy. The training volume, intensity, and frequency must be appropriate for the particular person. If training is too intense, the subject will struggle to get back to baseline, and no supercompensation will occur. If training is too easy, there will be very little adaptive response. If extremely easy training is continued over several training cycles, then the principle of reversibility will take effect. If the training load is adequate and the timing of the application of the training stress is correct, then a supercompensation effect will occur.

The fitness fatigue theory [2] has a premise that the fitness effect of training is slow changing and long lasting, while the fatigue effect of training is of shorter duration but of greater magnitude. The two factors, fitness and fatigue, are the immediate training effects of every workout. The most immediate effect of any workout is fatigue, but the long-term effect is the adaptive changes in the targeted motor qualities over time.

Supercompensation is a sports science theory that focuses on the elevated increase of glycogen in the muscles, but not only. It also increased possibilities of eliminating traces of fatigue, it means a level of fitness is higher. The process of supercompensation follows immediately after the training period, when the body is fatigued from the stress of the training.

During this time, natural processes in the body trigger to restore the level of energy and fitness that the individual possessed prior to the beginning of the training, and also prepare the body for another round of training by increasing the general energy level.

Additional training during the period of supercompensation is thought to be much better for the body, than if the training resumes, while the body is still in the recovery phase.

This is because during recovery, the body is simply attempting to restore itself to the same energy level it „knew" before the last round of training, so the training will not result in any noticeable increase in the basic fitness level of the individual.

By waiting until the recovery period is over and the period of supercompensation has begun, the individual is able to set a new level or standard that is higher than the previous fitness or energy level. Thus, the subject reaps the most benefit from the training within a shorter period of time.

When coupled with a sensible diet and a reasonable exercise program, observing this progression from the initial fitness level to the supercompensation level can greatly enhance the overall well-being of the athlete and increase the ability of the individual to compete in a number of sporting events with an enhanced amount of endurance and also strength.

Exercise causes the body to tire; rest allows the body to recover. By repeating this process, the body adjusts to the level of effort, resulting in an increase in physical performance.

For young people supercompensation is a necessary determinant to develop and for adult or old people – to maintain or slow down a decrease of individual performance level.

References

1. Bompa TO. Periodization Training for Sports, Human Kinetics. 1999.
2. Zatsiorsky VM. Science and Practice of Strength Training, Human Kinetics. 1995.

Citation: Szczepanowska E. Education of Healthy Training Throughout the Supercompensation Phenomenon. Austin Sports Med. 2019; 4(1): 1029.