

# Factors That Lead to Plateaus

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## Lesson Eight

***The objective of this article is to identify factors that lead to common weight or fat-loss plateaus not directly related to nutrition, but to how exercise and weight loss effect energy expenditure. (i.e., use of calories or resulting changes in 24-hour energy expenditure).***

First we will identify the problems, then list possible solutions. More empirical evidence exists on the solution than pure scientific data. There has been little motivation for the scientific community to study what goes awry with energy balance for anyone other than the obese population. In the obese population, the defect in energy balance is usually related to malfunctioning satiety controls. The fatness that ensues leads to a more sedentary lifestyle (eat more, move less). In this way, the genetic problems of the obese compound themselves. We will view the plateau problems and solutions as they relate to the typical health club member.

Before we dive into these issues, we will introduce the subject of energy balance. The facts are, if you take in fewer calories than you burn (establishing a calorie deficit) you lose weight or fat. Conversely, if you take in more calories than you burn, you gain weight. These facts are unarguable. Our bodies also have some kind of well-explored but not completely understood regulatory mechanism that works to keep our energy intake and output in balance.

For many people, problems start shortly after an initial weight or fat loss. They certainly start out in caloric deficit, by adding exercise and/or changing the diet,

or the weight or fat loss could not have occurred. However, they find the weight and fat loss slowing and eventually coming to a halt even though they continue to exercise and maintain the same food intake. In a nutshell, it appears that the body has figured out a way to establish a new food intake and energy expenditure balance. The original caloric deficit has closed. They are eating less, exercising more and the body is no longer changing. We call this the exercise/weight loss paradox. The very things we believe and do to stimulate our metabolism (increase the burning of calories) can eventually slow it in many cases. Indeed, it would be naive to think that adding cardiovascular exercise would significantly increase resting or non-resting energy expenditure (NREE) for any significant length of time, if one prevents body weight and composition from changing by not weight training and by re-feeding the energy expended by the exercise. Aerobic fitness would certainly improve but, in all probability, thermogenesis would not without an adaptation period taking place (i.e., body composition change and/or once aerobic fitness has improved). There are well-controlled studies that support the notion that exercise (especially aerobic) does not continue to support an increase in one's 24-hour metabolic rate. Therefore, any positive impact exercise has on metabolism may be an acute, transitory effect.

Human metabolic energy expenditure is remarkably flexible. Depending on one's degree of physical conditioning, oxidative energy expenditure can increase 10 - 20 fold between resting and peak effort. Severe caloric restriction can reduce energy expenditure 10 - 15 percent in one

week, indicating that it is not simply a loss of lean body mass. Genetically mediated variables must also play a role. This is documented by the fact that variables in resting energy expenditure (REE) per pound of lean body mass are familial characteristics. Weight gain in response to overfeeding is also determined, in part, by inheritance.

Most current studies of populations ranging from the obese through trained athletes concur that chronic exercise can lower one's REE and may also lower NREE. Considering that all reactions in the body consume calories, these conclusions are logical. The endogenous reactions that take place in response to new stimuli (especially in the untrained body) are many times greater than during a non-adjustment period, as the body makes the changes necessary to become accustomed to the new workload. These reactions include repairing muscle damage and subsequent hormonal changes accompanied by core temperature changes. All these new reactions can increase caloric burning until the body adapts to its new regime. Then, paradoxically, REE may actually be reduced from its pre-exercise level due to the body's new cardio-pulmonary efficiency as well as the completion of an adaptation phase. In summary, once habituation of exercise allows a person to transcend this adaptation period, the next effect may be down-regulation of metabolic expenditure in response to the energy imbalance induced by exercise.

The following are possible reasons for plateaus:

### **Adaptation-Phase-Over**

As mentioned at the beginning of this article, the adaptation phase can have a profound effect on REE. As the body adjusts to its new exercise regime (including resistance training), many catabolic and anabolic reactions take place

along with core temperature changes. When weight training is involved, the reactions continue for most of the day because of the increase in muscle protein activity. In other words, you have a longer "afterburn" from weight training than from just doing typical cardiovascular work. All reactions consume calories. Therefore, once the body becomes accustomed to the regime and there is no more adaptation, REE will be reduced markedly. To add fuel to fire, one loses not only the benefit of extra calories used during the adaptation phase but may end up burning fewer calories than pre-exercise regime values. This is due to an increase in cardio-pulmonary efficiency, including a reduced resting heart rate. Hence, it becomes necessary to create another adaptation period. The modified workload could include a simple change in the mode of cardiovascular activity (bicycle, treadmill, etc.) and/or the resistance routine. Other options for manipulating workload range from interval training (i.e., crossing the anaerobic threshold periodically during the cardiovascular routine) to an overall increase in energy output (avoid over-training, see #8).

### **The-Genetic-Component**

Apart from familial characteristics that determine the amount of calories equal weights of skeletal muscle consume in different individuals, genetics have a profound effect on compensatory conservation of non-exercise energy in the face of exercise stress. A study of seven pairs of identical twins revealed a dramatic difference in total weight loss and percentage of change in REE and NREE between the pairs, while all were on the same eating and workout regime. It is also tempting to embrace the idea that since thyroid\* status, brown adipose tissue and solute pump factors can swing 24-hour energy expenditure up to 50 percent, plus or minus, these components may have an effect on the exercise energy expenditure

as well. These factors are determined by genetic predisposition.

Finally, scientists at Johns Hopkins University have located a gene that contains the blueprint for a crucial bit of biological equipment called a beta-3 adrenergic receptor. It is part of the chemical machinery that regulates metabolism. Though their research involves seeking a cure for obesity and a defective gene, it would be naive to expect non-obese individuals' gene expressions and responses to be identical with this particular gene or any other gene for that matter.

\*It is possible to be hypothyroid, even with an adequate thyroid hormone output, because of biochemical differences in the receptor sites on your cells. This condition will show up on the basal temperature test.

### **Non-Resting-Energy-Expenditure-Reduction**

While REE may be reduced early on in an exercise program we also find, unfortunately, the energy cost of the exercise itself becomes reduced. Though this happens significantly later, it still contributes to plateau problems.

As mentioned earlier, loss of body weight has a significant effect on the NREE. New studies are revealing a reduction in the energy cost of the exercise itself when performing identical workloads. This reduction shows up after approximately eight weeks of regular exercise. In other words, the same exercise, duration and intensity performed by the same person begins to consume fewer calories. Two studies showed the reduction in NREE (including ambulatory energy expenditure) was 1.6 - 2 times greater after accounting for the expected reduction from loss of body weight. There are several possible mechanisms for this reduction of NREE. One way, already mentioned, is the loss of

weight in the limbs. Whether doing an aerobic class, or walking on the treadmill the limbs are being moved. If they become lighter, less restricted (not rubbing) and the body becomes stronger, all tasks are easier. Therefore, caloric requirements are reduced during exercise and at rest. It has also been shown that where one loses weight has a significant effect on the metabolic cost of exercise. Losing pounds from the limbs reduces the energy cost of exercise more than losing pounds from the torso.

Finally, we find that pulmonary functions improve after weight loss and as a result of exercise. This also contributes to weight-independent decreases in NREE. Though all we are mentioning in this category deals with adaptation, these are some of the fragments that contribute to this phase.

Including all of the above, there still appears to be an unaccountable reduction in energy expenditure during exercise in trained versus un-trained subjects. Studies have shown that trained runners performed with 20 percent greater economy than other non-trained athletes. It is tempting to attribute this reduction in exercise energy expenditure to the hormonal adaptations to training. It is well known that neuroendocrine responses play a major role in regulating substrate mobilization and utilization during exercise and these responses are modified by endurance training. For example, plasma norepinephrine and epinephrine levels increase less in trained subjects than in un-trained subjects during exercise performed at the same absolute intensity. Glucagon, growth hormone, cortisol and adrenocorticotrophic hormone levels also increase less during exercise in trained subjects. Though basically unexplored, this collective attenuation of hormonal output during exercise in trained subjects may contribute to the reduction in energy expenditure during exercise. These

adaptations clearly represent a unique response to training and are not simply a function of an increase in VO<sub>2</sub> max. Numerous studies have concluded these effects on training are evident only when the mode of exercise is the same as that used in training, even though VO<sub>2</sub> max may be identical under different conditions. This may be attributable in part to the proportions of energy used in vertical and horizontal displacement of the body. This offers a possible solution to a fat-loss plateau attributed to an increase in exercise energy economy due to training and its subsequent hormonal adaptations. By changing the mode of cardiovascular activity and maintaining the same intensity and/or partaking in interval training, we may be able to ameliorate this exercise energy economy dilemma.

### **Chronic Physical Stress (over-training)**

This is listed last because it is probably the result of all of the above, rather than a separate cause. However, there may be something beyond the effect weight loss, adaptation and training have on overall energy expenditure when too much exercise is involved for some subjects. This scientifically unexplained effect of too much exercise might be attributable to some form of adaptive thermogenesis (A.T.). A.T. represents a physiological response to some type of stress or change. The body is capable of adapting to undesirable conditions by actually reducing its energy requirements or by conserving energy. Excessive aerobic exercise may result in a reduction in metabolic rate due to the body's activation of, "survival mechanisms." These mechanisms, other than the five previously listed, are not clear.

When we reduce the amount of exercise, take time off or increase calories, many times the body seems to "let go." The body composition starts to improve again or at least remain unchanged. The fact

that the body composition, at the very least, does not worsen during this rest or active rest period gives us a new starting point (less workload) for a new adaptive response. It also seems to validate the possibility that some sort of "survival" mechanism has been working to conserve energy. If it were just the problems listed in 3 through 7, one could not explain the improvement or lack of change when reducing the exercise load. There seems to be a release in stress and the body, not feeling threatened any longer, finally ceases its protective mode (energy conservation). The threat perceived by the body is wandering too far from its genetic set point, the very set point we are trying to change. By reducing exercise, over-trained muscles get a chance to recuperate as nutrients can be used to repair and remodel tissue, instead of being used for energy, and this may possibly rev up the metabolism again.