

Non exercise activity thermogenesis (NEAT)

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Introduction

I recently attended one of the world's largest conferences in exercise science. The American College of Sports Medicine Annual Meeting, which this year was held in beautiful Denver Colorado. Conference rooms as far as the eye could see were filled with some of the world's greatest minds, either in the audience or presenting data which had not even been published yet. The science of muscle growth was discussed from a molecular, genetic, and holistic perspective, among literally every topic known in the exercise science world. For a hard working scientists such as myself, a conference such as this is comparable to placing a kid in a candy store, or better yet for my soon to be 4 year old nephew...Toys R us! You could imagine my disposition, too many conferences to attend and such limited time! But because I am president of a bodybuilding site, I tried to choose seminars related to muscular hypertrophy. However, with the number of seminars occurring I found myself in a dilemma. On a number of occasions two to three speakers were addressing issues on muscular growth at the same time! Fortunately I was able to get recordings of hundreds of the seminars for my own personal listening pleasure (what a relief).

What was interesting was that one of the most fascinating symposiums I attended was not related to muscle growth at all. In fact, it was not even about exercise! Instead it was on a subject known as **Non Exercise** Induced Activity Thermogenesis, and was headed up by Dr. Levine from the Mayo clinic and his colleagues. During the seminar one of the most intriguing things occurred. First all the speakers in the symposium stood for the duration of the talk, meaning even while one individual was speaking the others ignored their designated seats. Then, by the end of the talk the majority of the large crowd of mostly exercise physiologists were also standing while listening to the seminar, with their seats conspicuously left empty. What strange forces caused these individuals to leave their seats you ask? Take a seat...or better yet stand if you like and I'll explain.

How Humans Expend Energy

When we look at human beings we see all sorts of shapes and sizes. Some individuals are lean, and some carry too much body fat. For lean individuals, body fat is stored enough to last maybe 2-3 months tops, where as obese individuals can carry enough energy to last over a year in length (Levine, 2004). The variables which determine whether an individual is lean or obese are almost too many to count. For example, a bodybuilder can take in more energy than he or she consumes and still stay relatively lean simply because the excess nutrients are

directed towards muscle tissue rather than purely to fat. For sedentary individual however most excess energy is stored as fat. Of course even bodybuilders are constantly dealing with minimizing fat gain, if this weren't the case we wouldn't have to go on cuts so often. The variable of where nutrients go falls under the umbrella of nutrient partitioning. This is affected by both our diet and exercise. The second variable is definitely energy balance.

In general if energy consumed exceeds energy expended then we gain weight. Because not all energy is partitioned to muscle stores this energy is also stored as fat. Conversely when cutting the goal is to create a caloric deficit, where calories expended exceed calories consumed. The following article is concerned with energy expended.

Energy expended can be divided into basal metabolic rate, the thermic effect of food, and activity thermogenesis (Levine et al., 2006).

Basal metabolic rate is the energy you expel while at rest, and averages out to be about 60 % of total energy expelled in a given day. Studies show that the difference between individuals basal metabolic rates (e.g. what makes one person expend more calories than another) is explained mainly by differences in lean body mass (Levin, 2004). This is one of the reasons why when you are dieting your best bet is to do everything you can to maintain the lean body mass you gained while bulking, if not gain additional lean body mass. The formula is simple → when calories go down, anticatabolic agents should go up! This includes being extremely cautious about obtaining proper leucine intake (see this months article on leucine practical applications), HMB, fish oil pills, glutamine, high protein intakes, proper pre bed meals, and the consumption of some source of protein in the middle of the night.

The thermic effect of food accounts for 10-15 percent of calories expended in a given day. Essentially eating, digesting, processing and assimilating food requires energy. What is interesting is to study how to manipulate this variable, but that is a topic for another article. I can briefly say however that proteins have a greater thermic effect than other macronutrients, followed by carbohydrates, and then fats, which have very little thermic effect. Just by upping the proportion of protein in your diet you can metabolize more fat.

The final category was activity thermogenesis. According to Levine and colleagues this can be further divided into activity associated with exercise and the calories it expends and non exercise induced activity or NEAT. NEAT concerns activities which are physical but fall outside of exercise such as pacing, fiddling, typing, talking, standing, tying your shoes, and other occupational activities performed at work or school. Studies indicate that NEAT may explain the majority of the difference between individuals in terms of their energy expended in a given day. In fact, it ranges from 15-50 % of total calories expended in a given day depending on whether an individual is sedentary or active (Levin, 2004, Levin et al., 2006). For individuals who do not exercise this is critical. You will note however that exercise induced energy expenditure is manipulated typically through increased cardiovascular output.

Given the immense importance of NEAT to metabolizing fat, the following paper will analyze what components effectively lower or increase NEAT and how you can manipulate these components in your own program.

Environmental factors

There are a number of environmental factors affecting NEAT. One of the major factors is the development of time saving and leisure devices such as washer machines, dishwashers and elevators which have lowered NEAT. In one study Lanningham and colleagues (2003) analyzed the effects of activities such as washing dishes, walking to work, and climbing the stairs vs. using a dishwasher, driving, and taking the elevator and found that people who did not use labor saving devices expended an extra 120 calories per day (figure 1), which adds up to nearly 12 pounds of fat per year. Remember that changes in body composition are typically best viewed in chronic programs, as day to day variations are small.

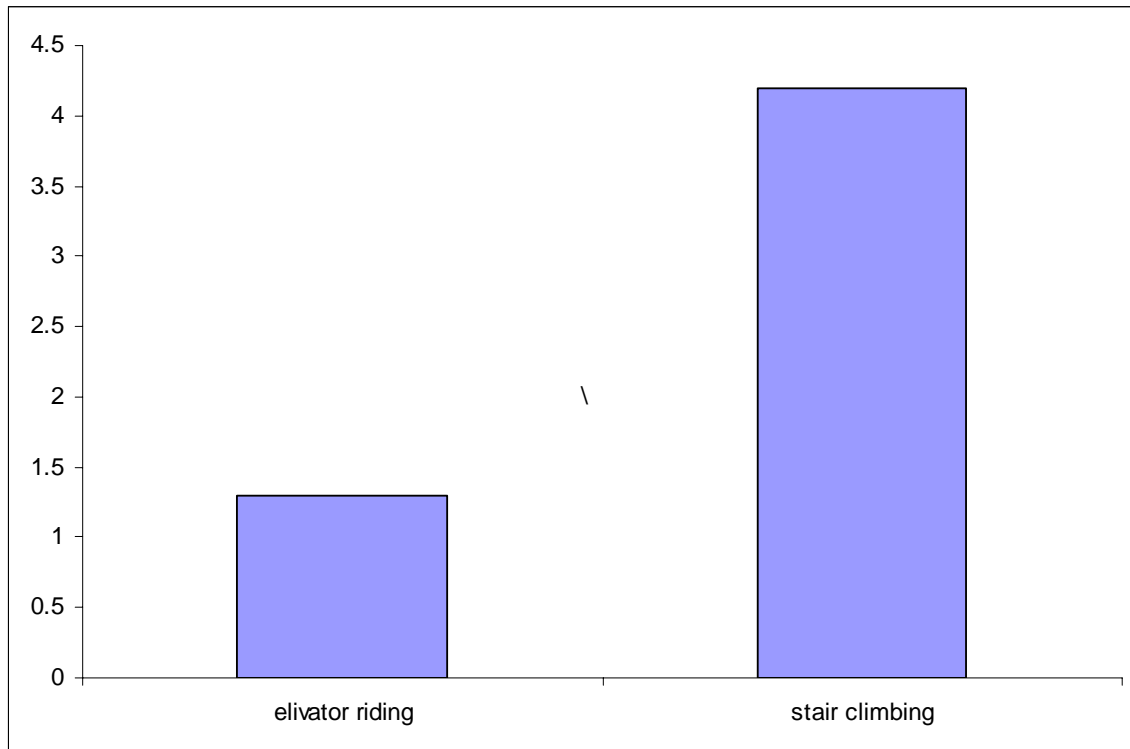


Figure 1. Example comparison of elevator riding compared to stair climbing.

In another study Levine and colleagues correlated or looked for relationships between sales of labor saving devices and obesity and found that as labor saving devices increased so did obesity, while in contrast food intake did not correlate!

A further factor effecting NEAT is occupation, with drastic differences in comparison of those whose jobs are labor intensive compared to sedentary desk jobs.

The seasons also effect NEAT for obvious reasons such as rain and cold and their effects on lowering opportunities for outside activities. Studies indicate that NEAT is double in the summer compared to winter months (Levine, 2004).

While environment plays an important role, a great deal of evidence suggests that NEAT is very much biologically dependent.

At the conference Dr. Levine and colleagues presented some of the most powerful evidence that NEAT is greatly related to genetics by comparing Obese individuals to lean individuals. Here's a summary of some of the data they presented. Lean individuals have higher levels of NEAT than obese individuals.

Explanations

It may simply be that obese individuals have a harder time moving around than leaner individuals, and so avoid NEAT activities.

To examine this possibility the Levine lab placed naturally obese rats on a diet until they had the same body fatness of their leaner rat counterparts. Still NEAT did not increase, suggesting a genetic component.

One of the suggestions is that we have a NEAT center in our brain which controls spontaneous activity (Levine, 2004). This center integrates incoming signals so as to increase or decrease NEAT depending on the situation at hand. One of the hormones identified to increase NEAT upon administration is orexin. Orexin administration increases NEAT, and as evidence would have it, when Orexins are administered to lean individuals they increase activity substantially more than obese individuals, suggesting that obese individuals may be resistant to the effects of Orexins.

Energy Availability As the primary regulator of NEAT

NEAT is directly correlated with energy intake. As energy intake increases, NEAT levels increase. Evidence even suggests that it is the proficiency of this process which determines whether or not individuals gain excess fat in response to overeating or not. For example Levine et al. in 1999 overfed a group of individuals, and found that fat gain was inversely proportional to increasing levels of NEAT. In fact, these scientists correlated changes in basal metabolic rate, changes in post feeding thermogenesis and changes in NEAT with fat gain. No significant correlations were found with the other measures, yet NEAT had a strong correlation as is seen in figure 2.

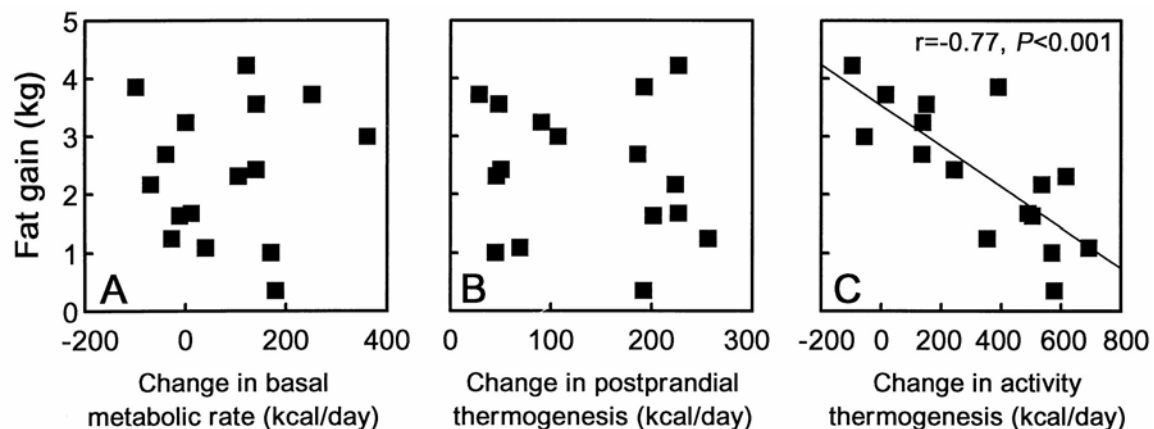


Figure 2. NEAT is inversely correlated with fat gain, when individuals are overfed.

Again, this may be both genetic and environmental. What is known is that obese rats do not increase NEAT to the extent that lean individuals do in response to overfeeding.

Another interesting finding is that during weight loss, much of the decrease in metabolism seen can be attributed to NEAT. For example, an individual who weighs more will expend more energy when walking or ambulating (pacing). In a fascinating experiment Drs Weigle and Brunzell took individuals who had lost weight and added weighted vests to them. They found that 50 % of the loss in energy expenditure was made up when the vest was put on. Perhaps along with calorie cycling during dieting you might try a weighted vest, imagine how great it would be if your metabolism did not lower or you didn't hit the dreaded plateau!

Further, it appears that as energy intake goes down, NEAT goes down as well. So, the current working theory is that as excess energy comes in, the human body regulates it with increased NEAT, or correspondingly decreased NEAT as energy intake decreases such as occurs during dieting.

How to apply the NEAT principles to your program for enhanced fat loss

NEAT or non exercise activity thermogenesis can account for as much as 50 % of the energy expenditure in activate individuals. Studies show that fat gain and loss are highly related to NEAT. In fact, it may be that the key to optimally dieting and sustaining fat loss, is to regulate NEAT levels. NEAT appears to be a factor of both environment and genetics. Further, when you diet, much of the loss in energy expenditure or metabolism that you experience is due to lowered NEAT, either directly through a brain center regulation of activities such as pacing, and fidgeting, or indirectly related to areas such as carrying less poundage.

What you should understand is that regardless of your genetics, you can manipulate NEAT by how you control your environment. First however you should understand the impact that NEAT activities have on increasing energy expenditure relative to resting levels. This can be done by looking at figure 3.

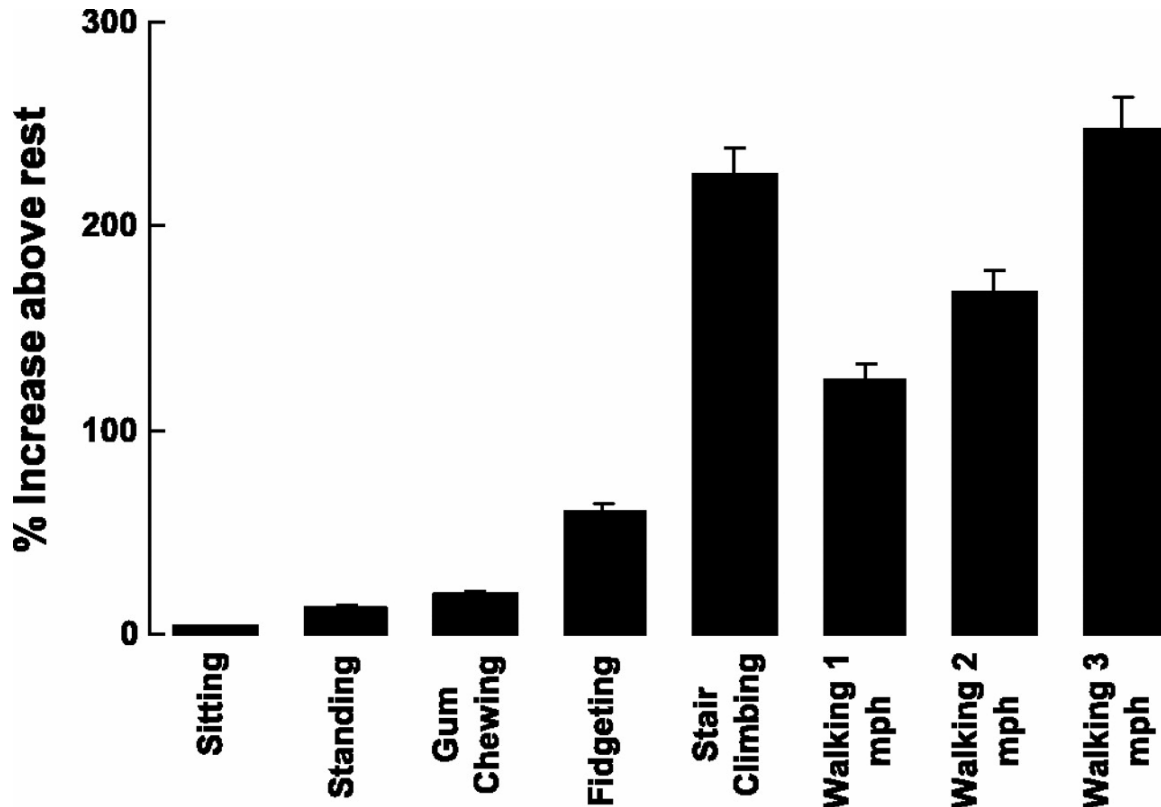


Figure 3. Comparison of energy expenditure of various activities relative to resting levels of energy expenditure. Adapted from Levine (2004)

As can be seen activities such as standing are much more energetically costly than sitting, whereas gum chewing can raise energy expenditure 20% above resting! Walking 1 mph as occurs when you pace doubles your energy expenditure!

Here are sample ideas of how you can enhance NEAT.

1. Instead of sitting in your office, move your computer screen and type writer up to standing level and spend the day typing while standing. All of a sudden your "desk job" becomes a standing job, and you will metabolize a substantially higher amount of calories per day. While it seems strange, I have personally seen my brother Gabriel adapt easily to this method.
2. When studying or reading a paper, try reading it while ambulating (pacing). Your energy expenditure will literally double!
3. Ignore the elevator and take the stairs. You might also not worry too much about parking right in front of the store. If there's a parking further away, take it.
4. Chew gum!
5. When dieting be extra conscious of NEAT levels as it may be the main reason why you stop metabolizing fat when you diet.

6. Just because you can sit, does not mean that you have to sit. I notice that whenever individuals have a chance to take a load off they do. But while dieting this may not be the wise thing to do.

The amazing thing about behavior is that it is modifiable with practice and experience. If you begin to implement these activities then they will become second nature, and you will substantially notice yourself becoming leaner.

Conclusion

As the title suggests Non exercise activity thermogenesis may be the key to Optimizing fat loss. In fact, I would say that the work of Levine and colleagues is revolutionary.

Finally, you can see why the crowd was standing, and perhaps why you are as well!

References

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