The Effect of a Slimming System Including a Lipolytic Cream and an Isometric Abdominal Exercise Regime and a Garment on Skin Temperature

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ABSTRACT

Topical creams composed of aminophylline and/or caffeine increase fat lipolysis in subcutaneous fat. If this occurs, then skin temperature should increase after cream application due to an increase in tissue metabolism. Experiments were conducted where the temperature effect from the combination of exercise, a cream containing aminophylline and caffeine, and a garment was assessed using infrared thermography. There were 52 subjects in the experiments (32 investigational and 20 controls). Baseline measurements were taken prior to the treatments. Participants then followed a 10-minute slimming system protocol which included applying the lipolytic cream (lipolytic group) , wearing an elastic compression belt for 10 minutes, and performing 3 minutes of abdominal contractions. Controls followed the same procedure, but used a placebo cream. Skin temperature measurements were then repeated after the belt was taken off and at 1, 2, and 3 hours post-belt removal. There were no significant differences in the skin temperature in the first 15 minutes after the cream was applied. Over the next 3 hours, skin temperature significantly increased for the lipolytic group ($p<0.01$) to a final value 5.08 degrees C above the baseline pre-cream temperature. The more overweight the subjects were, the greater the increase in skin temperature due to the thicker fat layer altered by the lipolytic cream. The correlation between skin temperature and BMI was significant ($p<0.05$). Controls only showed a very small temperature increase for the first 2 hours attributed to the abdominal exercise. Thus, a single application of the cream, belt and exercise had long lasting effects on fat metabolism as measured by skin temperature.

INTRODUCTION

Exercise in specific areas of the body has been, in some cases, shown to thin subcutaneous fat and remove uneven fat deposits called cellulite.[1] By increasing muscle

metabolism, exercise causes fat to be liberated throughout the body, and burned as fuel even hours after the exercise (EPOC).[1-3] This is mediated through the sympathetic nervous system.[4,5] Thus exercise can cause muscle strength to increase,[6-8] and there is a general increase in lipolytic activity, thinning subcutaneous adipose tissue.[9] There are compounds that can also increase lipolysis. Topical lipolytic compounds in the form of a cream have also been used for targeting girth and fat reduction.[10-15]

One successful lipolytic compound is aminophylline.[10,16] It is marketed under many names. These compounds have few side effects and mobilize fat under the cream.[10, 17-19] Caffeine similarly has been shown to mobilize subcutaneous fat through topical treatment.[11,12,15] This study was conducted to test such a cream to see if it increased metabolism in the subcutaneous fat of the skin as assessed by skin temperature after application of the cream and the use of a garment and a brief abdominal exercise program as a catalyst.

METHODS

The System

There are three parts to the slimming system that work together that is tested here. These are a compression garment, lipolytic cream (composed of caffeine and aminophylline), and abdominal isometric exercise. Compression garments have been used for centuries for body sculpturing.[20] In themselves, however, more often than not, the look is more cosmetic, ie, girdles, corsets, and other devices used to make the appearance of the loss of body fat and girth, but not actually causing much underlying loss of body fat and body girth.

Exercise is well documented for targeting specific areas of the body for toning. Exercise, especially isometric exercise, causes an increase in oxygen consumption not only during the exercise, but generates an EPOC that lasts for hours later.[21,22] It also causes toning of the muscles and body and liberates subcutaneous fat.

The third part of the system is the cream. The cream used in the studies is a lipolytic cream containing a few main ingredients, mainly caffeine and aminophylline. There is a long history in the literature demonstrating mobilization and loss of subcutaneous fat with either of these two components. Studies using both components also show that, together, they target the fat below the area they are applied causing slimming.

Body Fat Content

Body fat content was measured by an Impedance Plethysmograph (RJL systems, Clinton TWP, MI).

Thermal Camera

A Flir model E6 camera (Stockholm Sweden) was used for these studies to measure skin temperature. It was calibrated at the beginning of the study.

Lipolytic Thermal Accelerator Cream

The lipolytic cream is a proprietary formulation containing mainly two compounds, caffeine and aminophylline.

Placebo Cream

The placebo cream consisted of a lanolin skin cream with no ingredients known to increase lipolysis.

Subjects

One series of experiments was conducted where the temperature effect from the combination of exercise, cream and the garment was assessed using infrared thermography. There were 32 experimental subjects in the lipolytic cream group and 20 in the control group, with characteristics as shown in Table 1. All subjects had all procedures explained to them, and was approved by the Solutions

Table 1. *General characteristics of the subjects.*

	age	height	weight	BMI
experimental	49.0+/-12.6	164.4+/-8.0	92.6+/-19.6	33.7+/-8.0
control	49.4+/-10.1	162.4+/-5.6	91.0+/-21.5	34.5+/-8.0

IRB. There was no statistical difference between the groups.

The number of subjects used in the experiment was adequate to reach statistical significance. All of the measurements were conducted in a temperature controlled environment with appropriate procedures to clearly isolate the temperature effect of the Slimming system (such as the participants resting in a thermally neutral room prior to the start of the measurements, participants remaining stationary and relaxed in the thermally neutral room throughout the measurements, and not consuming any food or drink throughout the measurements).

Procedures

The participants arrived 30 minutes before measurements, and rested quietly in a controlled temperature room. Baseline measurements were taken prior to the treatments. Experimental participants then followed the 10-minute slimming system, which included applying the lipolytic cream to the abdominal area, wearing the elastic compression belt for 10 minutes, and performing the 3 minutes of standing abdominal isometric contractions. Skin temperature measurements were then repeated after the belt was taken off and at 1, 2, and 3 hours post-belt removal. The same protocol was used for the control subjects except a placebo cream was used.

RESULTS

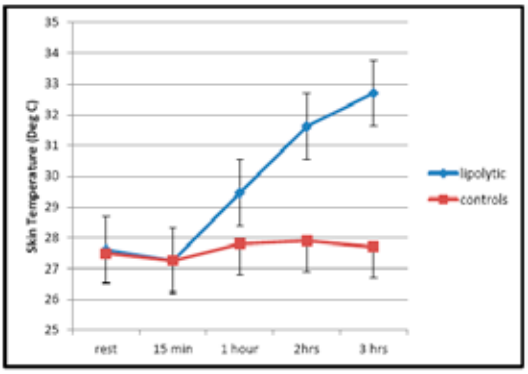
The results are shown in Figure 1. There was no significant difference in the skin temperature in the first 15 minutes after the cream was applied. However, over the next 3 hours, skin temperature significantly increased ($p<0.01$, ANOVA) to a final value 5.08 degrees C above the baseline pre-cream temperature in the experimental group. All subjects in this group experienced a temperature increase. The more overweight the subjects were, the greater was the increase in skin temperature. The correlation between skin temperature and BMI was significant ($p<0.05$). The temperature curve showed the increase was still slightly increasing at 3 hours, but had begun to plateau (indicating the temperature increase continued beyond the 3 hours). The correlation between BMI and the increase in skin temperature was significant ($r=0.295$, $p<0.05$). For the control group, there was no change in skin temperature in the first 15 minutes, but then it increased ($p<0.01$) over the next 2 hours by 0.4 degrees C. By the third hour, the skin temperature in the control group had declined, and was no longer significant ($p>0.05$).

DISCUSSION

The use of the system, that is the combination of the cream plus a garment and abdominal isometric exercise, demonstrated a significant increase in temperature throughout the test period. On 32 subjects (lipolytic group), this increase in temperature was monitored for 3 hours and, even after 3 hours, the skin temperature was still increasing. The rise in temperature cannot be due to the belt itself, because the garment was removed after 10 minutes. Further, exercise alone would not cause such a dramatic increase and continuous increase in muscle temperature.

In the control group, the increase was 0.4 degrees C. This small increase was caused by the exercise alone. Typically, with exercise alone, temperature will increase in the first hour or so and then begins decreasing.[23] However, here, temperature

Figure 1. *Relationship between skin temperature and time for the 52 subjects after administration of the skin cream.*



increased for the lipolytic group, and continued increasing not just for the first hour, but, continued increasing for 3 hours after the experimental procedure was over. There was no statistical difference in the temperature after the first 15 minutes, but temperature continued to rise showing increased thermal activity (increased metabolism in the abdominal area and subcutaneous tissue) for hours after the application of the cream and the exercise. Further, the temperature increase was fairly uniform across the abdominal area, and was not just due to one or two small areas increasing in temperature. For the lipolytic group, the increase in skin temperature above the 0.4 degrees C seen in the control group translates to an increase in metabolism and an increase in caloric expenditure in subcutaneous fat from the lipolytic cream. The BMI was correlated to the increase in skin temperature. This shows that the thicker the subcutaneous fat layer, the greater was the increase in skin temperature and hence, the greater increase in metabolism. The high BMI subjects had thicker subcutaneous fat than the thinner subjects. Greater subcutaneous fat would cause an increased reaction to the cream, and therefore, a higher skin temperature.

The mechanism of this increase in tissue temperature is certainly related to and consistent with published literature on the two principal agents in the lipolytic cream, caffeine, and aminophylline. Caffeine activates cyclic amp kinase in tissue and increases tissue metabolism, increasing caloric expenditure.[24] This certainly accounts for both the rise in skin temperature and the lipolytic effect of caffeine locally after the garment was removed.

In addition, aminophylline is well known to increase local fat metabolism and liberate fat from the subcutaneous area.[10,16] Exercise also increases metabolism.[25] With both agents used together, plus exercise, it is of no surprise that there was such a dramatic rise in tissue temperature and, as demonstrated in a companion study, a reduction in subcutaneous fat verified by girth loss and ultrasound imaging. The long-term fat loss seen in this companion study is related to the fact that the skin temperature, after application of the lipolytic agent, continued to rise after 3 hours. Thus, a single application of the cream, belt and exercise effected fat metabolism for several hours.

A temperature increase occurred in every participant indicating the metabolic effect occurs to everyone after each application. Subjects, during the 3-hour test period, did not complain of heat, perspiring, nor were there any adverse events.

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