A New Anti-cellulite Kit: Adipocyte Differentiation and Lipolytic Activity

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Abstract

Two main mechanisms are involved in the development of the fat mass of adipose tissue:

- A well-known mechanism is an imbalance between the processes of lipogenesis and lipolysis in differentiated fat cells.

- Another mechanism is the adipogenesis, which leads to the transformation of preadipocytes in differentiated adipocytes. The newly formed mature adipocyte has acquired the capacity to store triglyderides in its lipid vacuole.

We have shown, using RT-PCR method, that the slenderizing active ingredients inhibits the differentiation of preadipocytes into adipocytes by reducing the expression of mRNA coding for PPAR-γ which is a key transcription factor without which the differentiation of preadipocytes cannot occur. Moreover, the slenderizing active ingredient stimulates the lipolytic activity of mature adipocyte. This effect could be compared to the caffeine.

Finally, tested directly in vivo, the slenderizing active ingredient led to a significant reduction in abdominal circumference and thigh circumference and improved skin tone and elasticity.

Introduction

The development of cellulite, still called hydrolipodystrophy, corresponds to the accumulation of fat and reduced local microcirculation in the hypoderm. Cellulite is characterized externally by the appearance of excessive roundness in the hips, abdomen and legs, combined with an « orange skin » tufted appearance of the skin in women (1). Even though felt as bothersome by women, it is a not a disease. To a lesser extent it is even perfectly physiological, a secondary sex character.

Adipose tissue accounts for 15 to 20% of total body weight of a normal individual, equivalent to about 50 to 80 billion fat cells or adipocytes (2). Adipocytes are spherical cells, 40 to 120 μm in diameter that arise from precursor cells, preadipocytes via a process called adipocyte differentiation or adipogenesis.

The capacity of preadipocytes to differentiate into mature adipocytes at the end of adipogenesis is a determining factor for the development of the fat mass. The newly formed mature adipocyte has acquired the capacity to store triglycerides in its lipid vacuole. This is why hyperplasia of adipocytes increases the mass of adipose tissue.

Another well-known mechanism is also responsible for the excessive deposit of fat in adipose tissue: an imbalance between the processes of lipogenesis and lipolysis in differentiated fat cells, leading to hypertrophy of adipocytes.

The present work was focused on the mechanism of adipocyte differentiation, a new approach to the development of slenderizing active ingredients.

Adipocyte differentiation. In the course of adipocyte differentiation, fibroblast-shaped cells (preadipocytes) are transformed to spherical cells. Several steps are required for the transformation of preadipocytes to mature adipocytes, including changes in the expression of a number of genes. This phenomenon is accompanied by considerable modifications in cell morphology, and also of the extracellular matrix.

The process of adipocyte differentiation, or adipogenesis, depends on communication between the cells themselves and between the cells and their environment (3). This involves hormones and varied growth factors that positively or negatively affect adipogenesis.

Several families of transcription factors also participate in the differentiation program. Among them are key molecules such as C/EBPs (CAAT/Enhancer Binding Proteins) or PPARs (Peroxysome Proliferator-Activated Receptors) (4). PPARs are transcription factors belonging to the family of nuclear hormone receptors. Three phenotypes have thus far been described: α, β and γ and each isotype has its own site of expression. The PPAR types preferentially expressed in adipose tissue are isotypes γ. PPAR-γ induces the activation of a number of adipocyte genes and has been identified as one of the major factors in the transcription cascade leading to adipogenesis (5, 6). The expression of PPAR-γ is sufficient to trigger adipogenesis. It also participates actively in the regulation of this phenomenon (3, 7).

Blocking the PPAR-γ mechanism in preadipocytes inhibits the process of adipocyte differentiation (8). The use of a synthetic PPAR-γ antagonist reduces adipogenesis considerably (9).