The Effect of a Botanical Sphingosine Blend on Skin Physiology and Biochemistry

Authors: Walter P. Smith Ph.D., Future Beauty Laboratory, Wellington, Florida, USA
Michael A. Bishop, Active Organics, Inc. Lewisville, Texas, USA

Introduction

The skin contains a relatively high concentration of unique lipids including sphingosine, sphingosine-1P, ceramides and glucosylceramides. While focus on these lipids usually addresses their role in forming the *stratum corneum* skin barrier due to their membrane forming characteristics, they do have potent biological activities.

Ceramides can be synthesized *de novo* or generated from the breakdown of sphingomyelin in membrane bound organelles in the cell. Ceramides can be modified throughout the cell to generate other lipids with both structural and lipid signalling activity.

Sphingosine can be released from ceramides, by the enzyme ceramidase. Sphingosine has demonstrated roles in the skin inflammatory process as well as keratinocyte differentiation.

Phosphorylation of sphingosine is catalyzed by sphingosine kinase, an enzyme ubiquitously found in the cytosol and endoplasmic reticulum of most cells. Sphingosine-1P, a potent signalling agent can be thus generated on demand. S1P has been shown to promote angiogenesis for wound repair and increase synthesis of dermal matrix proteins.

Glucosylceramides (GluCer) are the most widely distributed glycosphingolipids in cells. GluCer is formed by the glycosylation of ceramide in an organelle called Golgi via enzymes called glucosylceramide synthetase or by the breakdown of complex glycosphingolipids through the action of specific hydrolase enzymes. In turn, certain β-glucosidases hydrolyze these lipids to regenerate ceramide. In addition to being critical in the formation of cellular membranes, GluCer have long attracted attention because of their supposed involvement in cell growth and differentiation.

Lipid signalling refers to any biological signalling event involving a lipid messenger that binds a protein target, such as a receptor, kinase or phosphatase, which in turn mediate the effects of these lipids on specific cellular responses. Both sphingosine and ceramides have been shown to be involved in a number of signalling reactions involving both the skin inflammatory process and in cellular reproduction and repair.

In this study, we have examined a botanical blend containing N-Phytosphingosine, glycosylated ceramides and other biological lipids for effects on skin cells and *in vivo* to determine how to optimize a mixture of these bioactive lipids to maximize their effectiveness on skin properties. Through direct actions, secondary signalling mechanisms, or being utilized to build cellular components, we observed our blend containing N-Phytosphingosine has profound biological effects.

In cell cultures utilizing keratinocytes and fibroblasts and *in vivo* we observed that this biological lipid could be optimized to affect the following properties:

- Production of procollagen was increased without an increase in cellular proliferation in young fibroblasts
- Increased proliferation in aged fibroblasts
- Increased keratinocyte proliferation without hyperkeratinization
- Increased skin cell renewal on subjects greater than 60 years of age
- Reduced severity of mild eczema and psoriasis (clinical grading)
- Increased wound healing rates
- Shortened resolution of UV induced erythema.

Overall results established that our botanical N-Phytosphingosine blend has profound biological effects which can immediately reduce damaging erythemic reactions and promote skin rejuvenation. Effects were observed in cell culture studies as well as in clinical tests.