Effects of pegylation on physical and biological activities of N-acetylphytosphingosine, a short chain phytoceramide

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Sphingolipids are important structural components of the stratum corneum lipids and serve the epidermal permeability barrier function. Recent investigations on biological activities of sphingolipids have revealed that they have a number of important biological functions in the cell such as cell proliferation and differentiation, anti-inflammation, mediation of signal transduction and many more. Having diverse biological functions, sphingolipids for example, ceramides, phytosphingoines and its short chain phytoceramides N-acetylphytosphingosine(NAPS) are widely being used as cosmeceuticals. However, there are some limitations in application since it is difficult to solubilize most sphingolipids in the wide ranges. We studied a useful approach in order to overcome the solubility problem. NAPS is linked to a non-ionic water-soluble polymer, poly(ethylene glycol) (PEG) . We present here the effect of pegylation of NAPS on its physical and biological properties. A series of pegylated NAPSs on the basis of the conjugates of NAPS with PEG were synthesized. The modified molecules were significantly less toxic than the original compound. Moreover, the chemical modification led to enhancing their solubility. The comparison of pegylated NAPSs with different degrees of derivation showed that all the compounds tested retained comparable level of some biological activities to that of native NAPS. Previously, NAPS had been shown to induce apoptosis. A characteristic DNA fragmentation was observed when a keratinocyte cells were treated with pegylated NAPS derivatives, indicating that they maintained the original biological activities. In addition, the modified molecules also retained the anti-microbial activity. Currently, further comparisons between the original and the pegylated NAPS for the inhibitory effect on protein kinase C (PKC) and other biological activities are being carried out and the results will be discussed. In conclusion, the pegylated NAPSs could be easily used in diverse applications as new water-soluble sphingolipid having anti-microbial, anti-inflammatory and apoptosis-inducing efficacies in the functional cosmetics.