"Skin-Omics": Use of Genomics, Proteomics and Lipidomics to Assess Effects of Low Molecular Weight Scleroglucan

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Keywords: LMW scleroglucan, skinomics, differentiation, moisturisation

Introduction

The stratum corneum, representing the outmost layer of the skin, is a vitally important barrier of the body and protects it from various environmental stress factors. In order to maintain its elasticity, suppleness and barrier function, the skin requires optimal water content. In order to guarantee these functions skin moisture is tightly regulated by two factors, namely by the integrity of the water impermeable barrier of the skin itself and by the content of water-binding substances in the stratum corneum.

In order to compensate epidermal water loss, topical application of substances with large water binding capacity such as polyvalent alcohols and polysaccharides can be a solution. Scleroglucan is a glucose polymer that forms a triple helical structure and represents a major constituent of the cell wall of fungi. These polymer chains essentially consist of (1→3)-β-linked glucose units wherein each 3rd unit is additionally (1→6)-β-linked to another glucose unit to form side branches [1]. Glucans in general are described to stimulate cells of innate immunity, namely monocytes and macrophages, to provide anti-infective potential, and to promote anti-tumour responses as well as wound-repair [2-5]. Recent studies identified several receptors including Dectin-1, Type 3 complement receptor, class A scavenger receptor and TLR-2 [6,7] that recognize glucans and play a pivotal role in the mediation of its biological effects. Since expression of these receptors is not only limited to cells of the innate and adaptive immunity but could also be demonstrated for epithelial cells, fibroblasts and vascular endothelial cells, it seems that glucan receptors are widely distributed throughout the human body [8-10].

Scleroglucan is a water-soluble beta-glucan secreted by *Sclerotium rolfsii* that protects the cells from dehydration by creating an extra-cellular matrix capsule. The large water binding capacity and its numerous biological activities predispose Scleroglucan as an active ingredient for dermatological and cosmeceutical applications. However, due to its high molecular weight, up to 1.200 kDa and following from this it's marked thickening abilities, the usage concentration of scleroglucan is limited. Depolimerisation of scleroglucan polymers is accompanied by decreased viscosity and allows usage at higher concentrations up to 1%. The present study was aimed at characterising the effects of low molecular weight Scleroglucan (LSG) on keratinocytes and included *in-vitro* analysis of gene expression, protein and lipid formation from reconstructed human epidermis as well as *in-vivo* determination of its effects on skin moisturisation.

Materials and Methods

Cell culture

Reconstituted human epidermis was incubated for 24h in standard maintenance medium at 37°C and 5% CO_2 before the start of the experiments. [11]. In order to characterise the effects of HA on reconstituted human epidermis, skin models were treated topically with 50 µl aqueous solutions with 0.5% of LMW Scleroglucan for 48h. As a positive control retinol was utilised.

RNA isolation

Total RNA was extracted from cultured skin models using RNeasy Mini following the manufacturer's guide. RNA concentration was assessed spectroscopically with the SmartSpec Plus. Purity and integrity of the RNA was