



Investigation into the delivery and efficacy of a unique *Avena Sativa* (Oat) Lipid Extract using Raman spectroscopic, immuno-diagnostic led analysis and skin evaluation.

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OBJECTIVES: Oat lipids are rich in phytoceramides which include the glucosylceramides. In this investigation, we analysed and investigated the delivery of a specific Oat Lipid Extract derived from *Avena sativa*, comprising ‘skin identical’ ratios of sterol, fatty acids and phytoceramides. This investigation is the first reported preliminary investigation of oat lipids utilising confocal Raman spectroscopy for the identification of oat ceramides from *Avena sativa* supported by Lipbarvis® transmission electron microscopy (TEM) and immunofluorescent analysis.

METHODS: Oil lipid class compositions were determined by single-dimension double-development high-performance thin-layer chromatography (HPTLC). Analysis of the oxidative stability of the Oat Lipid Extract was performed by RapidOxy. Raman spectra of lipids were obtained by confocal Raman spectroscopy Xplora. The potential of Oat Lipid Extract to increase the ceramide content of human epidermis was measured using confocal Raman spectroscopy and immunostaining using an ex-vivo Perfex™ human abdominoplasty model. Effects of Oat Lipid Extract on skin barrier function gene expression were evaluated using RT-qPCR technology in reconstructed human epidermis (RHE). Transmission electron microscopy using the Lipbarvis® and immunostaining technique was conducted on human skin derived suction blister following treatment for 8 weeks with Oat Lipid Extract. Immunostaining of hyaluronic acid, occludin, and ceramides were also performed.

RESULTS: HPTLC and GLC profiling of Oat Lipid Extract, revealed that of the ceramide classes identified, skin identical sphingosine and phytosphingosine bases were also present. A total polar lipid content of 40% (mg/100g lipid) of which **4% classed as ‘ceramides’ comprised ceramides/hydroxyceramides (1.36%), Glycosyl inositol phosphoryl ceramides (1.32%), and Glucosylceramides (1.32%).**

Raman profiling of Oat Lipid Extract was well correlated with stratum corneum and viable epidermis profiles. Oat Lipid Extract induced a significant increase in explant neutral lipid content 5 days post application. Polar lipid content was increased by 18% on Day 1 which further increased to 60% on Day 5 post application. Ceramide content of the skin was significantly increased as compared to the control and immunostaining, with image analysis revealed an increase in stratum corneum thickness.

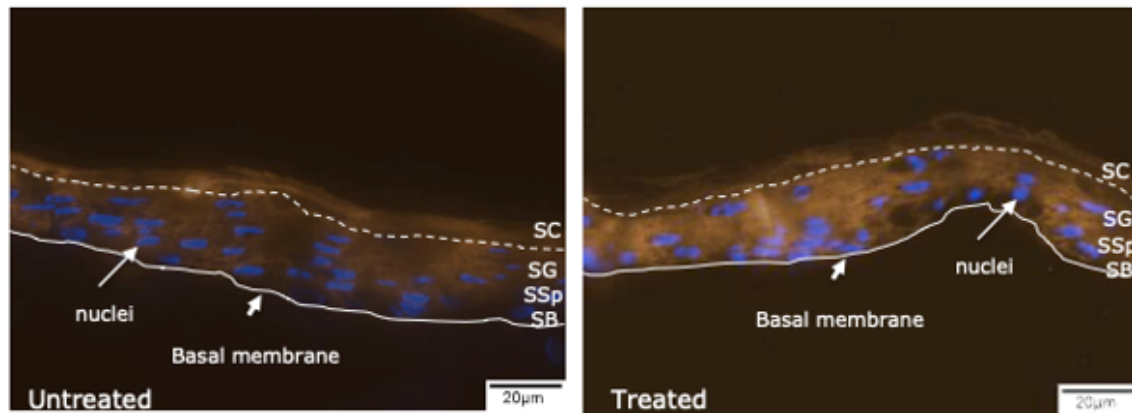


Figure 1: Ceramides fluorescent staining. Untreated: test site without product treatment. Treated: Oat Lipid Extract treatment twice daily for 8 weeks.

Oat Lipid Extract induced slight up-regulation of the gene expression of HAS3, and was more significant as compared to standard oat oil. Lipbarvis® TEM and immunostaining showed significant increase in the length of the intercellular lipid lamellae in the stratum corneum and the amount of detectable hyaluronic acid and ceramides in the epidermis.

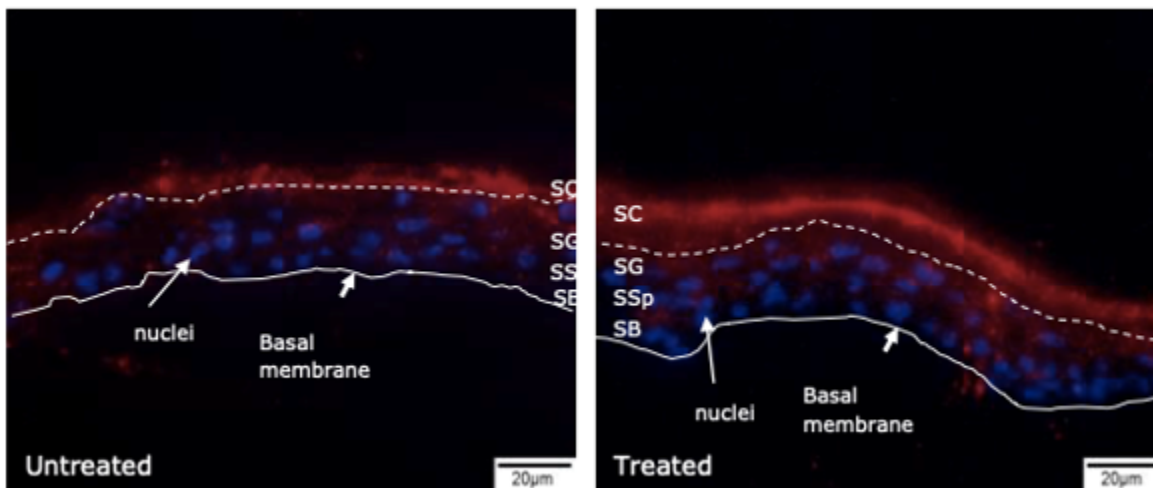


Figure 3: Hyaluronic acid fluorescence staining. Untreated: test site without product treatment, Treated: Oat Lipid Extract treatment twice daily for 8 weeks

CONCLUSIONS: Oat ceramides in the form of Oat Lipid Extract can be effectively delivered into the stratum corneum. This preliminary Raman and Electron microscopy Lipbarvis® study has given good insight into the possibility of Oat Lipid Extract mimicking the structure and function of the skin’s barrier. Further studies are required to provide evidence of the liquid crystalline changes that occur, and the molecular arrangement in the stratum corneum remains to be investigated.

Biography: Angus Robertson is Head of Sales at Oat Cosmetics, a UK company specialising in personal care ingredients derived from Avena sativa – the common oat. Angus studied Chemistry at Bournemouth University and later completed an executive MBA at Southampton Solent University. He started his career undertaking various laboratory and production management roles in the adhesive’s division of National Starch and Chemical. After 12 years he migrated from technical to commercial and spent a further 11 years engaged as a sales and marketing consultant. In 2011 he joined Oat Cosmetics, still in its embryonic stages, to develop and the sales strategy and grow it into a commercially viable business.

