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QUANTIFICATION OF NATURAL MOISTURISING FACTORS AT THE SKIN SURFACE USING A PORTABLE INFRARED SPECTROMETER DEVICE: A PILOT, CALIBRATION MODEL

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Background: Attenuated Total Reflectance (ATR) Fourier Transform Infrared Spectroscopy (FTIR) is a useful technique for the molecular analysis of surfaces, including the skin, with promising translational clinical potential. Skin surface levels of Natural Moisturising Factors (NMF) are a biomarker of filaggrin (FLG) status (both inherited and acquired) and skin dryness. FLG-related Atopic Dermatitis (AD) is associated with more severe/persistent disease.

Objective: To combine FTIR with chemometric analysis to generate a pilot calibration model for the *in vivo* quantification of NMF at the skin surface using a portable FTIR device.

Methods: This study was performed in a climate-controlled, skin barrier suite located at the University of Sheffield, UK. Subjects with either healthy skin or AD were recruited from the local Sheffield community and informed consent was obtained prior to enrolment in the study. A diagnosis of AD was made using the UK working party criteria, and disease severity classified by the eczema area and severity index (EASI) score. Genotyping for the 5 most common European loss-of-function *FLG* mutations was performed from buccal swabs. FTIR spectra of 4cm^{-1} resolution were collected from the volar forearm and antecubital fossa in conjunction with tape strips for the quantification of NMF components by High Performance Liquid Chromatography and o-phthaldialdehyde derivatization. Transepidermal water loss (TEWL) and stratum corneum hydration (SCH) measurements were collected as an assessment of barrier function. Ethical permission for this study was granted by the NHS Trent research ethics committee.

Results: Partial least squares regression modelling of absorbance in the mid infrared spectral region (1710-1185cm^{-1}) with skin surface NMF components determined by HPLC generated a predictive r^2 value of 0.90. Modelling was superior on the antecubital fossa compared to the forearm presumably due to the increased FTIR signal obtained from this site. Predicted NMF values correlated with *FLG* status, TEWL and SCH.

Conclusions: FTIR combined with chemometric analysis is a suitable technique for the instantaneous *in vivo* quantification of NMF at the skin surface. The use of a portable FTIR device makes this methodology suitable for any clinical setting, with the potential to inform long-term treatment strategies in AD.