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Advances in clinical application of Metabolomics: Treating children with atopic dermatitis.

Metabolomics, the quantification and comprehensive assessment of metabolites, has emerged as a novel and powerful tool in precision medicine¹. The great advantage of introducing metabolite analysis in clinical practice stems from the fact that they reflect both the genetic predisposition to a disease condition and the impact of epigenetic factors such as nutrition, environment, drug and lifestyle on phenotype^{2,3}. Gas chromatography/ Mass spectrometry methodology has allowed the detection of low quantity molecules in human biofluid samples. Targeted analysis of organic acids and fatty acids that participate in central biological pathways of the cell, provide information on nutrient deficiency, oxidation status and response to xenobiotics or pharmaceutical treatment^{4,5}. Thus, through the assessment of the overall health status early detection of disease and intervention to restore these deficiencies is feasible⁶.

Since the Human Metabolome Project launch in 2004 multiple studies have focused on the identification of metabolites as biomarkers. Providing a systematic approach, metabolomics have great application in diseases including those of skin⁷⁻⁹. Atopic dermatitis is the most common inflammatory skin disease among young children and affects up to 20% of children in developed countries. Primary symptoms of the disease occur before two years of age having major impact on quality life and socio-economic burden of the children and parents. The pathogenesis has not been fully elucidated probably due to high variability of the clinical phenotype along with the presence of other comorbidities¹⁰.

The primary therapeutic strategy against atopic dermatitis includes topical steroids and oral antihistamines which address inflammation and the alleviation of symptoms. Targeted Metabolomic analysis and subsequent personalized treatment were performed in over 30 Korean infants, that did not respond to standard therapeutic actions. Metabolomic analysis revealed significant metabolic disruption in Citric Acid Cycle compatible with mitochondrial dysfunction (4) due to xenobiotics toxicity, lack of the amino-acid glutamine and ubiquinol, cytochrome C dysfunction, and imbalances in selected fatty acids markers such as omega 6/ omega 3 ratio, arachidonic/EPA ratio and Homo-g-linolenic acid levels.

Our treatment consisted in addressing specific nutrient deficiencies and personalized diet based on the metabolomic analysis and resulted in improvement of the skin lesions within a few weeks from start of treatment in most cases.

Metabolomics can be a useful tool for the application of precision nutrition in children suffering from atopic dermatitis.

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