Metabolic profiling of developing infants: Term vs. Preterm at Birth

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Advances in neonatal medicine have seen an increase in the survival of babies born preterm. This has resulted in a significant burden to health and education services[1]. Preterm (<37 weeks of gestation) infants are usually treated in a neonatal unit until the infant is healthy enough to be discharged. Due to their metabolic anatomical and functional immaturity, these infants are associated with a higher risk of wide-ranging and long-term adverse medical consequences/outcomes. These include cardiovascular and metabolic disorders, abdominal obesity later in life and neurodevelopmental disorders. Preterm birth outcomes are more favourable with increasing gestational age; while birth weight is also a contributing factor[2]. The main issue with preterm birth is that there is currently no method to predict the adverse outcomes of the event.

Samples of biofluids were taken from infants shortly after birth and throughout the first few weeks of life. The infants in this study were born at either term (GA 37-41 weeks) or preterm (GA 24-36 weeks) at Chelsea and Westminster Hospital, London. This study includes urine and stool samples from approximately 150 infants. Biofluid samples taken from preterm infants were taken from birth and subsequently at weekly intervals until they were discharged from the neonatal unit. Whereas, urine and stool samples from term infants were collected predominantly in the first two weeks of life, and again about 8 weeks later.

Biological samples collected from infants are often limited in volume compared with adults. This is especially true for preterm infants who have other underlying conditions and often fed by parenteral nutrition. In earlier work, I established and optimised a method for human faecal water extraction for use in multi-platform analyses for metabolic profiling including UPLC-MS. These samples were analysed using Hydrophilic interaction liquid chromatography (HILIC) Mass Spectrometry (Urine (n = 69) and Stool (n = 195)).

After performing multivariate statistical modelling on the infant biofluid samples collected for this study, samples from each class could be seen to separate well, especially in the urine. Preliminary modelling of the data acquired from samples in this study revealed a number of differences between the urine metabolic profiles of term and preterm biofluids. As this sample set included samples taken over a period of up to 19 weeks, potential confounder in the interpretation of the data are the effects of time in the developing infant. This was especially evident for samples taken in the first week of life compared to samples taken later in life.

In conclusion, this study presents the metabolic variation in the infants born at term and preterm. From the data analysis, using principal component analysis (PCA), it clearly shows the variance in terms of birth gestational age and postpartum gestational age. Age is an important variable that contributes to the metabolic profile of biofluids and thus establishing the metabolic profiles linked to age has become a priority. The knowledge of an age-related metabolic profile can make the interpretation of data for other effects such as disease easier, which is important in biomarker discovery for disease diagnosis or prognosis.

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References:

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