Chromatographic and mass spectrometric analysis of urinary monosaccharide, disaccharides and oligosaccharides to identify carbohydrate metabolic diseases

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An increase in recessive autosomal carbohydrate defects have been identified in South Africa. Galactosemia, the ineffective metabolizing of galactose, leads to an increase in urinary galactose, cataracts, liver damage and neurological degeneration (Garrett, 1995). Glycogen storage diseases (GSD) are defined as defective glycogen synthesis and breakdown. Abnormal urinary oligosaccharides (tetrasaccharides), liver damage and death may occur (Rozaklis, 2002).

The current screening of carbohydrate diseases are typically done with thin layer chromatography. This method is fast and qualitative, but lack quantitative data. In this study a more sensitive semi-quantitative method is described, based on precolumn-derivatization and LC-MS separation and detection. Optimum derivatization of mono-, di-, and oligosaccharides were achieved with 1-phenyl-3-methyl-5 pyrazolone (PMP) (Rozaklis, 2002). The PMP-derivates further fassilitates retention of the analytes. Positive ion spectra was aquired in the eletrospray ionization (ESI) and collisional-induced dissociation (CID) modes. The PMP derivates all display a characteristic 175 m\z daughter ion which was used in multiple reaction monitoring mode (MRM) to detect individual analytes at different pre-specified pseudo molecular masses (M^{+1}). Apart from this an effective screening procedure for GSD and oligosaccharidoses was developed using precursor ion scans of m\z 175. Using this approach a GSD-patient was detected displaying an abnormal characteristic urinary tetrasaccharide profile.

Identification of mycopolisaccharidoses and lysosomal storage diseases (GSDs) are also being investigated. This new method may proof of great importance in screening for carbohydrate related disease (Ramsy, 2003).

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