

## Detection of glucose in the human brain at 7T

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**INTRODUCTION:** Detection of abnormalities in brain glucose metabolism can aid the diagnosis of various neurodegenerative conditions. Glucose concentration changes have been reported using CEST in animals and humans following intravenous administration [1,2,3]. Here we investigated whether a change in glucose can be detected using CEST in a healthy volunteer after oral administration of  $\alpha$ -D-Glucose, using MRS as a complementary measure.

**METHODS:** A healthy volunteer underwent two scanning sessions using a 7T scanner (Terra, Siemens, 32ch Rx, and 1ch Tx head coil). In the first session, measurements were taken immediately before and one hour after oral intake of 1.8 g of  $\alpha$ -D-glucose dissolved in 500 mL of water. The experiment was repeated a week later with water only. Both sessions were at the same time of day under identical dietary conditions and hydration. During both sessions, MRS (SLOW [4]), MPRAGE, and CEST datasets were collected. CEST imaging used a 3D snapshot GRE acquisition [5] at nominal  $B_1$  levels of 3.75  $\mu$ T, 5  $\mu$ T, and 6  $\mu$ T [6]. Magnetization Transfer Ratio asymmetry (MTRasym) was calculated from normalized, denoised, and B0-/B1-corrected Z-spectra [6]. MTRasym values were reported for gray matter (GM) and white matter (WM) before and after ingestion.

**RESULTS:** Changes in MRS spectra were observed after glucose ingestion, showing a reproducible pattern different from that after pure water intake. The changes slightly differed from glucose peaks in the phantom, suggesting the contribution of other metabolites. Figure 2 shows the MTRasym contrast for water and glucose ingestion experiments. No significant change is observed after water ingestion, but a significant change is seen in both WM and GM after glucose ingestion, with a greater change in GM.

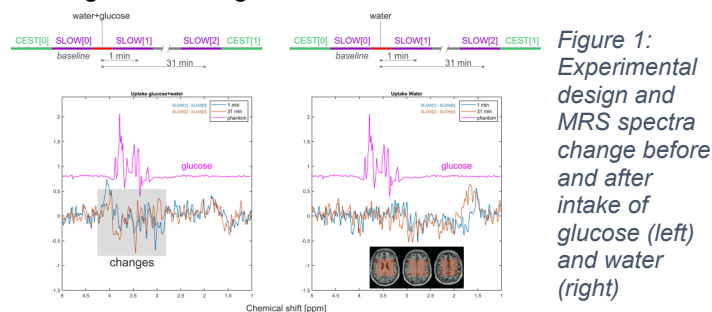


Figure 1: Experimental design and MRS spectra change before and after intake of glucose (left) and water (right)

**DISCUSSION:** The proposed CEST experiment detected changes after oral glucose intake. Further experiments are needed to establish the reproducibility of these effects and compare them with other contrast agents. The observed GM and WM contrast is consistent with the higher metabolism in GM tissue.

**CONCLUSION:** Changes in MTRasym were detected after oral intake of glucose in a healthy volunteer. Further tests are needed on multiple volunteers to confirm our findings.

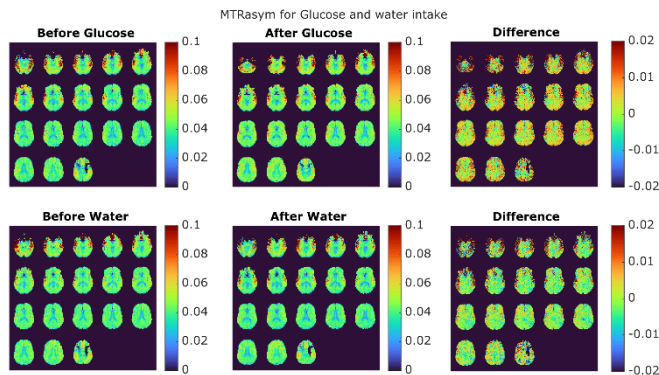


Figure 2: MTRasym contrast before and after water and glucose intake. The difference is reported in the third column.

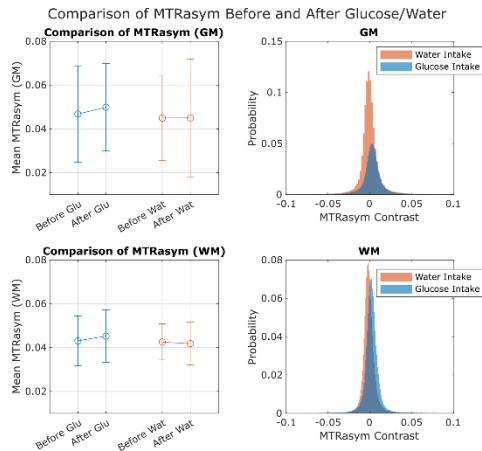


Figure 3: MTRasym values averaged in WM and GM tissue before and after glucose and water intake. The histograms show the distribution of contrast values before and after intake. Significant difference is found between glucose and water intake.

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