Introduction. A concussion is a brain injury caused by forces applied to the head or another part of the body, causing the brain to experience rapid rotational and translational accelerations [1]. Athletes participating in contact sports have a high risk of sustaining a concussion, which can lead to structural and metabolic changes in the brain. Our group previously found reduced glutamine levels in the prefrontal white matter of female varsity rugby athletes [2]. However, this study was limited by the absence of a non-contact control group, and we could not rule out an exercise effect. Therefore, the objective of this study was to quantify changes in brain metabolite levels in non-contact female athletes over the course of a sports season. It was hypothesized that MRI brain metabolite levels would not significantly change.

Methods. Participants enrolled (ages 18-22) belonged to a women’s varsity rowing and swim team (n=31). MRI was acquired using a 3.0T Siemens MRI scanner (Erlangen, Germany) at the beginning of season (In Season), and followed up at the end of season (Off Season). Magnetic resonance spectroscopy (MRS) was acquired from the prefrontal white matter using single voxel point-resolved spectroscopy (PRESS: TE/TR=135/2000ms, voxel=2x2x1.5 cm3, 192 averages). Spectra were post-processed using in-house software to measure absolute N-acetyl aspartate, choline, creatine, glutamate, glutamine, and myo-inositol. A multivariate ANOVA was used to compare rowers and swimmers, followed by an ANOVA between non-contact (Rowers and Swimmers), contact (Rugby) and concussion (Rugby).

Results and Discussion. No significant differences were found between rowers or swimmers (p > 0.05). Therefore, for further analysis, the rowers and swimmers were combined into a single non-contact group. Contact athletes had significantly greater glutamine levels than non-contact athletes at the In- and Off-Season time points (F = 10.97, p < 0.0001). As hypothesized there was no change in glutamine levels in non-contact athletes over the season (p > 0.05). We confirmed that the reduction in glutamine levels in concussed rugby athletes was significantly different from non-contact athletes (F = 3.5, p < 0.05). This suggests that the reduction in glutamine levels is not due to an exercise effect. However, the greater glutamine levels in contact athletes than non-contact athletes may be the result of sub-concussive hits over the course of previous seasons, resulting in a shift in metabolic demand. No other changes in metabolite levels were found. Future studies are needed to determine if changes in glutamine correlate with recovery from concussion.