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Longitudinal changes of brain microstructure and function in nonconcussed female rugby players

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Study objective

To examine longitudinal changes in brain microstructure and function in female athletes who play contact or noncontact sports.

What is known and what this paper adds

Participants in contact sports have repetitive head impacts over time. These findings demonstrate longitudinal changes in the brain's microstructure and function in otherwise healthy, asymptomatic athletes participating in contact sport.

Participants and setting

The analysis includes data from 73 female varsity rugby players (contact athletes) and 31 age-matched female varsity swimmers and rowers (noncontact athletes). Data were obtained during the in- and off-season.

Design, size, and duration

Sports Concussion Assessment Tool and head impact accelerometers were used to monitor symptoms and impacts, respectively. Resting-state fMRI was used to measure network connectivity patterns and diffusion-tensor imaging for quantification of diffusion parameters (i.e., mean diffusion [MD], fractional anisotropy [FA], radial diffusion [RD], and axial diffusion [AD]). Linear mixed-effects model was used for diffusion data analysis.

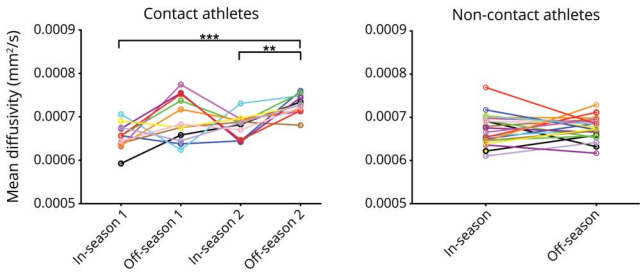
Primary outcome measures

The primary outcomes were between-group differences in diffusion parameters and functional connectivity patterns, both cross-sectionally (contact vs non-contact) and longitudinally (in. vs off-season).

Main results and the role of chance

There were significant differences across all diffusion metrics within the white matter skeleton when comparing concussion-free contact against non-contact athletes. Relative to the noncontact athletes, the contact athletes exhibited higher MD, RD, and AD levels and lower FA levels in many white matter tracts involving the cingulum and corpus callosum, as well as the white matter within deep brain structures like the brainstem. They also showed hyperconnectivity in the default mode and visual networks. The contact athletes, but not the noncontact athletes, exhibited diffusion parameter changes between the in- and off-season timepoints, and some contact athletes exhibited progressive changes over multiple seasons.

Figure Longitudinal MD changes in contact athletes. $^{**}p < 0.01$; $^{***}p < 0.001$



Bias, confounding, and other reasons for caution

Some contact athletes might have had undiagnosed concussions during the study.

Study funding/potential competing interests

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A draft of the short-form article was written by M. Dalefield, a writer with Editage, a division of Cactus Communications. The corresponding author(s) of the full-length article and the journal editors edited and approved the final version.

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