packaged foods followed food labeling changes that went into effect in 2006.[1] Further labeling changes to specify whether a food product contains any quantity of TFAs would further increase transparency of a food's TFA content.

While we agree with Mr Katarey and Ms Francis that it is possible for a product labeled zero *trans* fat to have close to 0.5 g of *trans* fat per serving, we are unaware of any published data on the distribution of TFA content for foods labeled zero *trans* fat but still containing some partially hydrogenated oil that are necessary to estimate the proportion of these foods with close to 0.5 g per serving.

We agree with Drs Backholer and Peeters that there are no known health benefits of industrially produced TFAs. We also agree that we cannot be sure that further food labeling changes would eliminate exposure to partially hydrogenated oil for all individuals. While we are not aware of any current data to indicate that persons of lower income have higher dietary intakes of TFAs or that less expensive brands of the same food product have higher TFA content than the more expensive brands, we agree these are important areas of research.

A recent FDA study provided evidence of differences in the TFA content of different brands of the same food.[2] For example, different brands of frozen pizza contained from 0 to 5 g of TFAs per serving. Therefore, elimination of partially hydrogenated oils from packaged foods would eliminate these differences and would help persons who may only have access to specific brands and those who are not aware of the different content levels of TFAs.

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Conflict of Interest Disclosures: The authors have completed and submitted the ICMJE Form for Disclosure of Potential Conflicts of Interest and none were reported.
Disclaimer: The findings and conclusions in this report are those of the authors and do not necessarily reflect the official position of the Centers for Disease Control and Prevention.

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RESEARCH LETTER

White Matter Integrity in the Brains of Professional Soccer Players Without a Symptomatic Concussion

To the Editor: Soccer is the most popular sport in the world, with more than 250 million active players.[1] It is the only sport in which the unprotected head is a primary point of contact when heading the ball. In other contact sports, the deleterious long-term effects of repetitive traumatic brain injury (TBI), such as impaired white matter integrity,[2] are well recognized.[3] However, whether frequent subconcussive blows to the head lead to TBI remains controversial,[4,5] although evidence suggests impaired neuropsychological function in soccer players.[5] We evaluated concussion-naive soccer players using high-resolution diffusion tensor imaging (DTI), which is highly sensitive for detecting alterations in white matter architecture.

Methods. All right-handed male soccer players from 2 training groups of an elite-level soccer club in Germany were approached to participate. All were trained since childhood for a career in professional soccer. A comparison cohort of swimmers, which is a sport with low exposure to repetitive brain trauma, was recruited from competitive clubs to match on age (group-matched), handedness, and sex. Exclusion criteria were history of concussion or any other neuropsychiatric disorder. The local ethics committee approved the study and written informed consent was obtained.

A DTI sequence with 64 diffusion directions was acquired on a 3T magnetic resonance scanner (Verio, Siemens Healthcare) in July and August 2011. Group analyses were performed using automated whole-brain, tract-based spatial statistics[6] for the following measures of diffusivity: fractional anisotropy, mean diffusivity, radial diffusivity, and axial diffusivity. Fractional anisotropy and mean diffusivity have been shown to be sensitive markers for mild TBI.

Axial diffusivity and radial diffusivity measure axonal and myelin pathology. Voxel-wise statistics were used to investigate group differences at a 2-sided significance level of $P < .05$, corrected for multiple comparisons. Voxels with a significant group difference were merged into a single cluster. Diffusivity measures were obtained for each individual and a linear regression model was applied to test for group differences adjusted for age and years of training. SPSS version 20 (SPSS Inc) was used.

Results. Twelve of 40 soccer players (mean [SD] age, 19.7 [1.6] years; mean duration of playing soccer, 13.3 [2.9] years) and 11 of 20 swimmers (mean [SD] age, 21.4 [2.8] years; mean duration of training, 9.3 [2.9] years) met the inclusion criteria. Three swimmers were excluded from the statistical analyses for anatomic or technical problems.

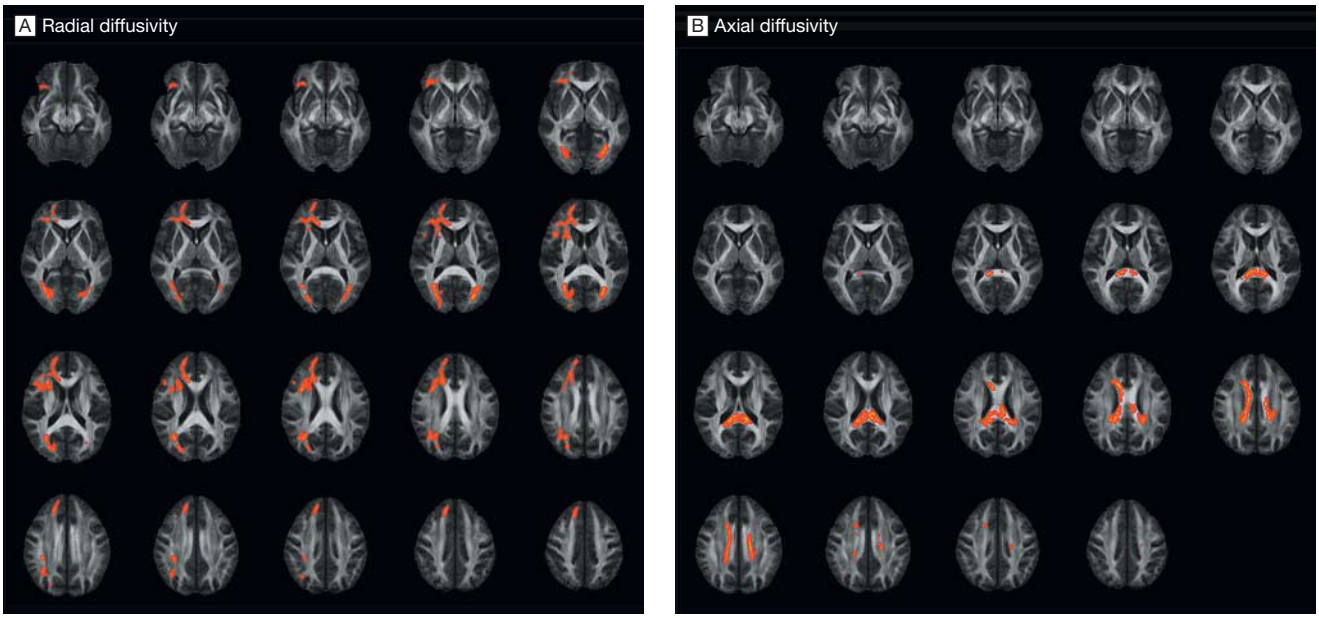
Widespread differences between groups were found, with increased radial diffusivity in soccer players (mean, 0.000444 [95% CI, 0.000427-0.000461] mm^2/s vs 0.000368 [95% CI, 0.000356-0.000381] mm^2/s in swimmers) in the right orbitofrontal white matter, the genu and anterior portions of the corpus callosum, association fibers involving bilateral inferior fronto-occipital fasciculus, bilateral optic radiation, and bilateral anterior cingulum, right anterior, right superior, and bilateral posterior corona radiata, right anterior limb of the internal capsule, right external capsule, and right superior frontal gyrus (FIGURE 1A).

Axial diffusivity was higher in the corpus callosum in soccer players (mean, 0.00156 [95% CI, 0.00154-0.00158] mm^2/s vs 0.00143 [95% CI, 0.00140-0.00146] mm^2/s in

swimmers; Figure 1B). No significant differences were found for fractional anisotropy or mean diffusivity. Cluster analysis revealed significantly higher radial and axial diffusivity in soccer players; age and years of training had no significant association with diffusivity values (FIGURE 2). Structural images as read by a neuroradiologist showed no abnormalities.

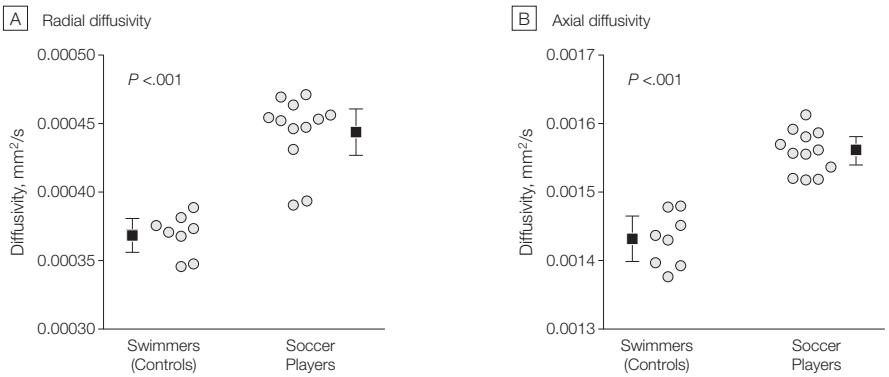
Comment. This study found differences in white matter integrity in a small sample of soccer players compared with swimmers. Although only participants without previous symptomatic concussion were included, advanced DTI revealed widespread increase in radial diffusivity in soccer players, consistent with findings observed in patients with mild TBI, and suggesting possible demyelination.

Figure 1. Results of the Tract-Based Spatial Statistics (TBSS) Analysis



The diffusion tensor for each voxel was estimated by the multivariate linear fitting algorithm, and the tensor matrix was diagonalized to obtain 3 pairs of eigenvalues (λ1, λ2, λ3) and eigenvectors. Voxelwise summary parameters included fractional anisotropy, radial diffusivity ([λ2 + λ3]/2), axial diffusivity (λ1), and mean diffusivity (λ1 + λ2 + λ3). Group analyses were performed using whole-brain TBSS[6] for the following measures of diffusivity: fractional anisotropy, mean diffusivity, radial diffusivity, and axial diffusivity. For all analyses, threshold-free cluster enhancement was used to obtain significant differences between groups at $P < .05$. After accounting for multiple comparisons using the family-wise error rate, the voxels highlighted in red demonstrate significantly increased radial diffusivity and axial diffusivity values for the soccer group compared with swimmers.

Figure 2. Diffusivity Measures for Each Individual



Voxels with a significant group difference as revealed by Tract-Based Spatial Statistics (Figure 1) were merged to a single cluster. Circles indicate individual values, squares indicate mean values, and error bars indicate 95% confidence intervals. Diffusivity measures were obtained for each individual and plotted for the 2 study groups. Linear regression showed no significant association of age or years of training with radial diffusivity ($P = .13$ and $P = .12$, respectively) or for axial diffusivity values ($P = .22$ and $P = .54$, respectively).

The etiology of the findings, however, is not clear. One explanation may be the effect of frequent subconcussive brain trauma, although differences in head injury rates, sudden accelerations, or even lifestyle could contribute. Additionally, soccer players showed increased axial diffusivity in the absence of increased radial diffusivity limited to the corpus callosum, possibly resulting from specialized training or neuroinflammation.

Limitations of the study include small sample size, single cross-sectional evaluation, and lack of information regarding functional outcomes. Future studies are needed to confirm the results and elucidate the etiology and effects of white matter alterations in soccer players.

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Author Contributions: Drs Koerte and Shenton had full access to all of the data in the study and take responsibility for the integrity of the data and the accuracy of the data analysis.
Study concept and design: Koerte, Reiser, Shenton.
Acquisition of data: Koerte, Ertl-Wagner, Reiser.
Analysis and interpretation of data: Koerte, Ertl-Wagner, Zafonte, Shenton.
Drafting of the manuscript: Koerte.
Critical revision of the manuscript for important intellectual content: Koerte, Ertl-Wagner, Reiser, Zafonte, Shenton.
Statistical analysis: Koerte.
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CORRECTIONS

Error in Text. In the Original Contribution entitled "Effect of Adjuvant Chemotherapy With Fluorouracil Plus Folinic Acid or Gemcitabine vs Observation on Survival in Patients With Resected Periampullary Adenocarcinoma: The ESPAC-3 Periampullary Cancer Randomized Trial" published in the July 11, 2012, of *JAMA* (2012;308[2]:147-156), the median survival for the ampullary pancreatobiliary group was transposed with the median survival for the ampullary intestinal group. This article has been corrected online.

Data Error in Table: In the Original Contribution entitled "Low-Dose Aspirin for Primary Prevention of Atherosclerotic Events in Patients With Type 2 Diabetes: A Randomized Controlled Trial," published in the November 12, 2008, issue of *JAMA* (2008;300[18]:2134-2141), there were incorrect data in Table 1. The correct numbers (percentages) for "past smoker" were 274 (22) in the Aspirin Group and 246 (19) in the Nonaspirin Group. The article has been corrected online.