

NEWS / HEALTH

Amateur soccer players show changes in brain structure, study finds



Two players go for a header during a Suffolk County high school game in 2021. Credit: James Escher

By Nicholas Spangler

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Updated December 4, 2023 6:53 pm

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After two years of soccer, players who headed the ball the most showed changes of brain structure similar to cases of mild traumatic brain injury, with a slight but measurable decline in memory, according to a recent study.

Researchers followed amateur adult soccer players from Long Island and across the tristate area. The study joins a growing body of research into the cumulative effects of subconcussive injuries that athletes may ignore or not notice because of no immediate symptoms.

In extreme cases, repeated head injuries can lead to degenerative conditions such as chronic traumatic encephalopathy, or CTE, sometimes found in the brains of people who have played contact sports or been exposed to explosions.

The study, presented late last month in Chicago at the annual meeting of the [Radiological Society of North America](#), is the first to “show that there’s a measurable decline in what the brain structure looks like over a two-year period in healthy young adults,” said lead author Dr. Michael L. Lipton, professor of radiology at Columbia University’s Vagelos College of Physicians and Surgeons and an affiliate professor of biomedical engineering at the school.

What to know

- **After two years of soccer, players** who headed the ball the most showed changes of brain structure similar to cases of mild traumatic brain injury, according to a recent study.
- **About 100,000 Long Islanders play** organized soccer in youth and adults leagues and many more do so in informal leagues or in pickup games.
- **Prominent figures in Long Island’s busy** youth soccer scene said they would seek guidance to interpret the study's findings

Earlier studies in the field examined retired professional football players, but “these are regular people who go to school, work and play soccer recreationally,” Lipton said.

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More than 25 million Americans play soccer, the most popular sport in the world. About 100,000 Long Islanders play organized soccer in youth and adults leagues and many more do so in informal leagues or in pickup games, said Peter Pinori, secretary-general of the [Eastern New York State Soccer Association](#), the sport's regional governing body.

In a long-running study that began in 2012, Lipton and his fellow researchers followed 148 players between ages 18 and the early 40s in recreational leagues for two years or longer. The study used a specialized questionnaire to determine how often each individual played, practiced and headed the ball, and in what types of situations. Researchers then sorted the players into low-, medium- and high-exposure categories, with high-exposure players heading the ball as many as 23,462 times over the study duration.

Studies have shown that a collision between a player's skull and a soccer ball typically generates force and acceleration that is weaker than a hit in football or a punch in boxing. A 2001 Journal of Athletic Training study suggested that most opportunities for heading occur at ball velocities of less than 40 mph – below concussive levels, but measurable nonetheless.

Tom Combs, executive director of the governing body for scholastic sports in Suffolk County, Section XI, said in an interview that he would raise the new heading study at a meeting in the coming weeks of the organization's safety committee.

“These are physicians, physician assistants, trainers and athletic directors, and we'll discuss this,” Combs said.

Section XI already follows a concussion management protocol that requires training for coaches and keeps concussed student athletes out of action until they are cleared by medical professionals, he said. Officials for Section VIII, the Nassau body, did not comment.

Brain imaging

To measure changes in the brain and cognitive function, at both the start and end of the study, players underwent brain imaging and took a “shopping list” test commonly used in cognitive research that required them to memorize 15 items, recalling the items immediately and after a 20-minute hiatus.

Two-year brain scans using an MRI technique called diffusion tensor imaging showed microstructural changes to the high-exposure players’ brains’ frontal white matter, Lipton said.

White matter is composed of billions of nerve fibers and axons, the filaments that send electrochemical messages to neurons and the spinal cord. The changes involved a loss of axons and myelin, the protective sheath around nerves, and potentially other changes related to inflammation, Lipton said.

“The frontal lobe is central to a lot of functions that make us most human,” he said, including memory, attention, mood, cognitive control, planning and personality.

Players with low and medium exposure to headings improved on the two-year shopping list test, a finding Lipton said was unremarkable because performance on cognitive ability retests often improves. But high-exposure players did worse. The performance decline — an extra item or two forgotten for some athletes — was slight enough that it would likely go unnoticed outside a clinical setting, Lipton said. The results approached but did not meet the formal threshold of statistical significance, meaning researchers could not rule out the possibility that the decline in cognitive function was due to chance.

“What this means for the long term, whether these people go on to an overtly clinical disease, remains to be seen,” Lipton said.

Experts who reviewed the research delivered at the conference said the findings were potentially concerning, but none said it was time to give up soccer.

“This research provides further evidence that repetitive head impact in sports is associated with adverse effects on the brain, which could have a negative impact on long-term brain health,” said Dr. Suzie Bash, a neuroradiologist and medical director for RadNet, a medical imaging company, in an email. But, she noted, soccer can actually benefit brain health because it leads to increased oxygen and blood flow.

“The hope is,” Bash said, “that research like this will be used to help establish evidence-based guidelines for heading so that players can make informed decisions.

Two Long Island brain specialists said the results pointed to the need for further research.

“There was not a huge association with actual clinical cognitive performance — there was a trend, but it wasn’t significant statistically,” said Dr. Jamie Ullman, director of neurosurgery at North Shore University Hospital in Manhasset. Given what is known, he added, “Maybe we need to be very cautious and more introspective about what constitutes appropriate game play.”

Stony Brook Medicine vascular neurologist Dr. Lauren DeNiro said longer studies following more athletes could be valuable.

“The question is, are these effects permanent, or is it something that’s reversible?” she said. Recruiting more female athletes — only 27% of the study’s athletes were women — also could provide rich data, because men and women recover differently from injuries.

LI youth soccer

Prominent figures in Long Island’s busy youth soccer scene said they would seek guidance to interpret the study’s findings. “It is concerning,” said John Fitzgerald, sporting director and director of coaching education for the [Long Island Junior Soccer League](#), one of the largest youth leagues in the country, with 50,000 players.

"A study like this is something we would look closely at and say, 'Do we need to impose any restrictions?' "

Fitzgerald said his league followed the guidance of the [United States Soccer Federation](#), which in 2015 banned intentional heading for players 11 and younger and limited heading for players in 12-and-under and 13-and-under programs. A spokesman for U.S. Soccer did not respond to a request for comment.

Bruce Stegner, coach of the Massapequa High School girls team, one of the region's dominant programs, said the issue of brain health in soccer was "something to be concerned with." He has required some of his players — and his own daughter — to wear shock-dampening headbands when playing because of concussion risk, he said.

Brent Masel, national medical director for the [Brain Injury Association of America](#), said he recommended ending heading altogether in youth soccer and using protective headgear.

Guidance on concussions on the U.S. Soccer website, however, says use of headgear "specifically to reduce concussion risk is not supported at this time." That guidance does not address subconcussive impacts.

Stegner said heading was unlikely to be eliminated, at least in the game's higher levels. "It would be like having football without tackling," he said.

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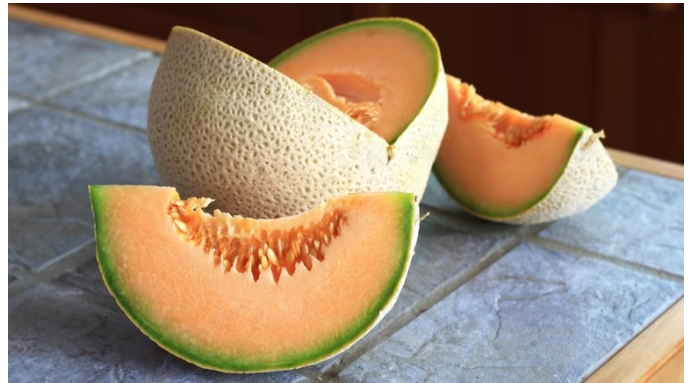
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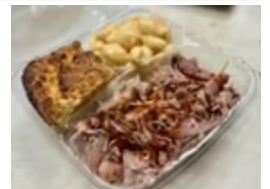


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