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Weekend park footballers, take note: recent research suggests that soccer heading might cause long-term brain damage, more than previously believed. A new study by the Radiological Society of North America (RSNA) found that amateur soccer players, aged 18 to 53, who frequently headed the ball showed unusual white matter in the brains deep grooves, areas linked to severe head injuries. These changes were most noticeable in the frontal lobe, a region prone to trauma during heading. Repeated impacts also linked to worse verbal learning skills. While most participants hadn't suffered concussions, the study highlights risks from non-serious head impacts. Dr. Michael L. Lipton, the study's lead author, warned that these brain changes could tie to future cognitive issues, similar to CTE. Though soccer is seen as less risky than collision sports like rugby, this study urges governing bodies to consider rule changes. The research, presented at RSNA's annual meeting, used advanced MRI scans to track brain microstructure and cognitive function. While some heading is deemed safe, the exact threshold for harm remains unclear. Players experiencing symptoms like dizziness or headaches should seek medical advice. The findings add to growing concerns about long-term risks from sports-related head impacts, potentially linking to neurodegenerative diseases like Alzheimers. Soccer heading linked to decline in brain structure and function over two-year period, study finds The intricate connection between the frequency of heading in soccer players and brain abnormalities has long been a topic of study among researchers. A recent comparison between soccer players and swimmers revealed striking differences in their brain structure, with soccer players exhibiting abnormalities in their white matter fiber tracts. This disruption can lead to cognitive symptoms such as memory problems, anxiety, and depression, as well as sleep disturbances and headaches. Studies are ongoing to explore the long-term effects of these brain abnormalities on soccer players, but results are not yet clear-cut. It is uncertain whether the abnormalities will resolve over time or persist indefinitely. Furthermore, there remains a significant gap in understanding the threshold of force required to cause a concussion, with current measurements showing that hits as low as 50-60 g's can result in concussions, while other players have experienced symptoms without apparent head trauma. The complexity of this issue stems from the unique combination of biomechanical forces and biological factors at play. Variables such as age, neck strength, hydration status, and sex all influence an individual's susceptibility to concussion. As a result, researchers are cautious in drawing conclusions about the risks associated with soccer heading. For soccer parents, recommendations include restricting youngsters under 14 from heading the ball, playing tackle football, or engaging in full-body checks on ice hockey. This is due to the increased vulnerability of young brains, which have not yet developed sufficient myelination and neck strength to withstand impacts. While some advocate for a complete ban on heading in soccer, others argue that this would be premature, given the limited evidence available. Instead, researchers suggest educating youngsters on safer techniques, such as practicing heading with beach balls, to mitigate the risks associated with soccer heading. The Effects of Soccer Heading on Brain Structure and Function: A Review of the Literature Soccer is the most popular sport in the world, with over 265 million players worldwide. However, despite its popularity, soccer has been linked to a number of head injuries, including concussions and subconcussive impacts. Several studies have investigated the effects of soccer heading on brain structure and function, with mixed results. A prospective study of female middle-school soccer players found that heading the ball accounted for 30.5% of concussions, while a retrospective analysis of high-school soccer players found that heading was responsible for 30.6% of concussions among boys and 25.3% among girls. Head injury in soccer can result from either direct contact or contact with the ball while heading it. Players may use their head to impact the ball in order to pass, move down the field, or score a goal. However, this action also poses a risk of injury, particularly to the neck and brain. The scientific community has recently begun to focus on the role of subconcussive impacts, which can occur during heading and may represent an additional mechanism of cumulative brain injury. These impacts can cause neuronal dysfunction in the absence of concussive symptoms and may lead to long-term changes in brain structure and function. Recent studies have used neuroimaging techniques to investigate the effects of soccer heading on brain structure. One study found that male former professional soccer players showed significant central atrophy with widening of the lateral ventricles after long-term exposure to heading. Another study found high-frequency heading was associated with lower FA at three locations in temporo-occipital white matter. However, not all studies have found significant effects of soccer heading on brain structure and function. For example, one study found no differences in brain structure between male professional soccer players and track athletes. Players and Controls: Biochemical Markers of Brain Injury ##ENDARTICLE Repeated subconcussive head impact has been linked to cognitive decline in soccer players, according to a recent study. The researchers compared male professional soccer players with age- and gender-matched elite track athletes regarding symptoms of head and neck injuries, as well as MRI abnormalities. Repeated heading injuries in male professional soccer players have raised concerns about their impact on brain function and structure. Research suggests that these subconcussive impacts may alter brain chemistry and lead to cognitive impairments. NGF and BDNF, members of the neurotrophin family, were found to be elevated in response to heading exercise, which may indicate microtrauma caused by repetitive heading. These findings suggest a possible association between heading and altered brain neurochemistry. However, other studies have produced contradictory results. Koerte et al. (29) evaluated brain neurochemistry in male former professional soccer players using magnetic resonance spectroscopy. The study found significant increases in choline and myo-inositol, markers of membrane disruption and glial activation, respectively. Myo-inositol levels were also positively correlated with lifetime estimate of headings. In contrast, Zetterberg et al. (30) examined serum and cerebrospinal fluid concentrations of biomarkers of brain injury in male amateur soccer players after a training session involving heading. The results showed no significant differences in biomarker levels between players who performed 10 or 20 headings and those who did not participate. Slnhackle and Sojka (31) also explored the effects of immediate heading exposure on serum concentrations of S-100B, a biomarker of brain injury. The study found no significant increases in S-100B levels after heading sessions. Tysvaer and Lchen (32) investigated neuropsychological performance in male former professional soccer players compared to age- and education-matched hospitalized patients with no history of head or neck injuries. The results showed that 81% of the soccer players had some degree of impairment, while only 40% of the controls had mild impairments. The findings from these studies highlight the need for further research into the effects of repeated heading injuries on brain function and structure in soccer players. While some studies suggest a possible association between heading and altered brain chemistry, others have found no significant differences in biomarker levels or cognitive performance. Matser et al. (7) investigated the cognitive effects of heading in professional soccer players compared to non-contact sport athletes. The study included male soccer players and a control group of elite non-contact sport athletes. The results showed that soccer players performed poorly on verbal and visual memory, planning, and visuosperceptual processing tasks compared to the control group. A subsequent study by Downs and Abwender (33) found that soccer players performed worse than swimmers on conceptual thinking and reaction time. Webbe and Ochs (34) discovered that male amateur and professional soccer players with high self-reported estimates of heading experienced poorer performance on tests of verbal learning, verbally based conceptual performance, planning, and attention. Rutherford et al. (35) found that cumulative head injury and cumulative heading were marginal predictors of poorer performance in soccer players compared to rugby and non-contact sport athletes. Zhang et al. (38) reported that female amateur soccer players experienced slower reaction times and decreased executive functioning compared to non-soccer players. In contrast, Tysvaer and Storli (39) found that 50% of professional soccer players reported acute symptoms after heading, while only 4.7% described prolonged symptoms due to heading. Putukian et al. (40) discovered no differences in cognitive performance between soccer players who participated in heading practice and those who abstained. Janda et al. (12) found no correlation between the number of ball impacts and cognitive performance, except for a weak inverse association involving verbal learning in the second year. Stephens et al. (41) reported no difference between groups in scores of all tests, with no relationship between cumulative head injury or heading and cognitive functioning. Straume-Naesheim et al. (42) found no association between estimated match or lifetime heading exposure and cognitive performance. Kaminski et al. (44, 45) discovered no correlations between the number of headings and neuropsychological performance, as well as no differences in cognitive measures over a soccer season. Kontos et al. (46) reported no differences in cognitive performance or symptoms among low, moderate, and high heading exposure groups. Vann Jones et al. (48) found 10.9% of retired professional soccer players scored positively for possible mild cognitive impairment or dementia, with no association between heading position or length of career. The study examined the cognitive impact of soccer participation on players with or without loss of consciousness. The findings showed that soccer players had poorer performance on verbal and visual memory, planning, and visuosperceptual processing tasks compared to controls. Moreover, the number of concussions incurred during soccer participation was negatively associated with cognitive functioning. Field position also played a role in performance, as forward and defensive players performed poorly on some tasks. A separate study compared male and female soccer players with swimmers on neuropsychological tests assessing motor speed, attention, concentration, reaction time, and conceptual thinking. The results indicated that soccer players performed worse than swimmers on measures of conceptual thinking. Although this study has several limitations, it shows that there is no evidence of cognitive impairment caused by subconcussive and concussive trauma in soccer. Kaminski et al. (44) investigated the relationship between short-term heading exposure and scores on cognitive function and balance in female high school and college soccer players. The researchers found no significant correlation between total number of headings taken and change in scores from pre-season to post-season in both groups. Furthermore, there were no differences observed between the three groups in post-season scores of neuropsychological tests, which measured concentration, immediate memory recall, and verbal memory. However, the college group had a poorer balance score than the other two groups. Moreover, the high school and control groups showed slight improvements from pre-season to post-season, while the college group did not change. In another study, Kaminski et al. (45) evaluated computerized neuropsychological test performance before and after a competitive soccer season and measured the number of headings per match. The results indicated no relationship between purposeful heading and neuropsychological performance. Interestingly, two measures showed small but significant improvements over baseline, which was attributed to a test-retest practice effect. Kontos et al. (46) investigated male and female amateur soccer players on computerized cognitive performance and symptoms. Participants completed the Immediate Postconcussion Assessment and Cognitive Testing (ImPACT), a previously validated test battery used to assess and manage concussions in sports. The researchers recorded observed numbers of headings for each player during two randomly selected practices and games for each of the soccer teams during a season. The results showed no differences in computerized cognitive performance or symptoms among low, moderate, and high heading exposure groups. A recent study by Vann Jones et al. (48) questioned whether long-term heading exposure was associated with persistent cognitive decline. Male retired professional soccer players were required to complete a self-assessed test of cognition. The results showed that 10.9% of the responders scored positively for possible mild cognitive impairment or dementia. The impact of soccer on brain structure and function is a topic of growing concern, with many studies investigating the effects of heading on cognitive functioning, brain structure abnormalities, and biochemical markers of brain injury. Concussions in Soccer: A Growing Concern Among Female Middle-School Players and Professional Athletes The impact of soccer heading on brain health has been a topic of increasing concern among researchers and medical professionals. Evidence suggests that heading in soccer may be associated with cognitive dysfunction, particularly in female players. The dark side of soccer: The risks of heading the ball on brain health have become increasingly concerning for players, coaches, and parents alike. The mechanics of heading a soccer ball involve forces equivalent to a punch from a heavyweight boxer, which can generate impacts that slosh around gray matter like a water balloon in a washing machine. The potential risks associated with soccer heading in youth players is a pressing concern that requires immediate attention. Many organizations have implemented age restrictions on heading in youth soccer, aiming to reduce the risk of long-term consequences. Proper heading technique and training are also crucial, as they can help distribute the impact throughout the body rather than concentrating it on the skull. Technological advancements play a significant role in reducing the force of impact, while new protective gear like headbands aim to absorb some of the shock. Monitoring and management of head impacts have become increasingly sophisticated, with some teams using sensors to track the number and intensity of impacts players experience during training and matches. The current evidence suggests that frequent heading may lead to long-term consequences, but research is still ongoing, and there's much we don't yet fully understand. Awareness is key, and players, coaches, parents, and governing bodies need to be informed about the potential risks and take appropriate precautions. A closer examination of other sports involving head impacts can provide valuable insights into effective prevention strategies. The debate surrounding soccer heading highlights the importance of finding a balance between preserving the beautiful aspects of the game and protecting the health of those who play it. New study reveals that frequent heading in soccer may cause more brain damage than previously thought, particularly in women. Researchers from the Radiological Society of North America analyzed MRIs of over 400 people and found that soccer players who headed the ball at higher levels exhibited abnormality of the brain's white matter. The majority of the damage was found in the frontal lobe of the brain, which is beneath the part of the skull that soccer players are taught to use for heading. Dr. Michale Lipton, senior author of the study and professor of radiology at Columbia University Irving Medical Center in New York, stated that the potential effects of repeated head impacts in sport are more extensive than previously known and affect locations similar to where CTE pathology has been seen. The study's findings suggest that heading may cause damage to the white matter near the sulci, which are grooves in the brain's cerebral cortex. The researchers used diffusion MRI technology to analyze the microstructure close to the surface of the brain and draw their conclusions. They found that head-bops that don't cause immediate traumatic injury can still affect the brain in the long run. Previous studies have confirmed that headers have caused injuries to the white matter in soccer players' brains. The study's findings have implications for the mitigation of head injuries in soccer, particularly for children and youth players. Association TF updated heading guidance was announced for under-sixes to under-18s, aiming to reduce the risk of head injuries in young players. Further research is needed to fully understand the effects of repeated head impacts in sport on brain health. However, the study's findings highlight the importance of addressing head injuries and promoting safe practices in soccer. The effects of soccer heading on brain function and hemodynamics, as well as its impact on cognitive performance and neurocognitive performance in athletes, have been extensively studied. Research has shown that repeated exposure to sub-concussive soccer headers can lead to hyper-acute effects on brain function and hemodynamics, including changes in blood flow regulation and cognition. Studies have investigated the relationship between soccer heading and anterior cruciate ligament (ACL) injury risk, as well as the potential for soccer heading to cause damage to the brain's white matter. Additionally, research has focused on the long-term effects of repeated soccer heading on brain structure and function. A 2023 study published in Frontiers in Human Neuroscience found that former high-level female soccer athletes had reduced cortical thickness and impaired neurocognitive performance compared to non-contact sport athletes. Another study published in Scand J Med Sci Sports in 2023 found that soccer players who engaged in ball heading were more likely to experience anterior cruciate ligament injuries. The 2020 study "Associations of apolipoprotein E 4 genotype and ball heading with verbal memory in amateur soccer players" by Hunter LE et al. found an association between the apolipoprotein E 4 genotype, ball heading exposure, and impaired verbal memory in amateur soccer players. A comprehensive review of the literature on purposeful heading in American interscholastic and collegiate soccer players was published in 2020 in the Journal of Science and Medicine in Sport. The study found that purposeful heading was associated with increased risk of head impact and potential for brain damage. Recent studies have investigated the use of wearable technology to track head impact during soccer heading, as well as the potential for immersive virtual reality training to improve soccer heading technique and reduce injury risk. A 2023 preliminary investigation into the efficacy of such training found promising results in improving cognitive performance and reducing injury risk. Overall, the existing research suggests that repeated exposure to sub-concussive soccer headers can have significant effects on brain function and hemodynamics, as well as cognitive performance and neurocognitive function in athletes. Further research is needed to fully understand the risks associated with soccer heading and to develop effective strategies for preventing head injury in athletes. ### References (automatically generated)1. Mez J et al. (2023). Neuropathologic and clinical findings in young contact sport athletes exposed to repetitive head impacts.2. Johnstone DM et al. (2023). The brain's weakness in the face of trauma: how head trauma causes the destruction of the brain.3. Kaminski TW et al. (2020). A comprehensive prospective examination of purposeful heading in American interscholastic and collegiate soccer players. Note: The references are automatically generated from the provided text and may not be a comprehensive list of all relevant studies on the topic. Reduced risk of head injury in soccer: a systematic review. Traumatic brain injury is a significant concern for females, with some research suggesting that women may exhibit a protective response to such injuries, which could be misinterpreted as sex bias. A study published in CNS Neurol Disord Drug Targets found evidence of neuroprotection in female subjects who suffered traumatic brain injury, suggesting that women's bodies may have an inherent mechanism to mitigate the damage caused by the injury. This discovery has sparked debate about whether this response is a genuine protective effect or simply a result of sex bias. ###ARTICLE

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