

Is it time for evidence-based protective strategies for heading in youth football?

Shaun Sutehall ^{1,2} Lulu Ralison,³ Jonathan Power,^{4,5} Daniel B Hawcutt^{1,6}

BACKGROUND

Regular participation in sports, such as football (soccer), has positive effects on both physical¹ and mental health.² Despite these benefits, concerns have been raised about the potential neurological damage caused by playing football. Acute head/neck injuries in youth football have been reported to occur at a rate of 0.25 injuries per 1000 hours played,³ which is substantially lower than lower leg injuries (4.08 and 6.54 injuries per 1000 hours played, in males and females, respectively).⁴ While unproven, there are concerns that long-term exposure to repeated 'subconcussive' impacts (without the presence of injury or concussion) could alter brain white matter structure, but the potential for purposeful repetitive heading of the football to cause negative effects on the brain remains uncertain and under-researched.^{5, 6} Although there have been significant steps made by governing bodies to reduce the number of concussions associated with football playing,⁷ the potential health risks caused by repeated head impacts that do not result in concussion remain unknown.^{8, 9} This editorial explores the current evidential landscape regarding heading in football to facilitate and inform carefully planned future research.

CURRENT STATE OF PLAY

In an effort to protect youth football players, in 2021, England Football introduced detailed guidance on heading during training at every age group in the amateur and professional game.¹⁰ This includes the complete removal of heading practice during training for U11 and younger, a graded increase in the advised heading

frequency up to U18, and the removal of any deliberate heading in matches for U11 players. While these changes are proposed as a positive step for the protection of youth football players, there remain considerable unknowns, including determining the number of headers performed in youth football (including during competition, training and casual play). There also exists a sparsity of evidence that describes whether and how any potential damage is caused through repeated head impacts and when this might begin or develop. It is therefore difficult to elucidate any positive effects of the introduced guidelines in this regard. Similarly, quantifying the effects of purposeful heading (or conversely, the effect of heading restrictions) in children and extrapolating findings to 'explain' neurological conditions in adults will be a significant challenge. It will also be difficult to separate the role of aerial competitions (and any resulting head-to-head or head-to-extremity collisions) from the role of repeated heading in any neurological assessments as both will be reduced following restrictions on heading.

In adult, professional football in the UK, guidelines have been introduced to limit the number of high force headers (those from passes over 35 m, crosses, corners and goal kicks) to no more than 10 in any training week.¹¹ The profiling of players by sex, age, playing position and the number of headers per match allows training to be tailored accordingly. However, there are challenges in monitoring and policing the number of heading episodes in adult professional football, and they may prove even more challenging to implement in youth football environments, where many of the head impacts may occur outside of organised play.

RESEARCH AND POLICY NEEDS

To date, the research on these repeated head impacts has focused on adults, with mixed results. Some research has found no effect on autonomic function such as heart rate variability or cardiac baroreceptor sensitivity,¹² while others have identified increased corticomotor inhibition and

decreased memory performance following an acute bout of football heading.¹³ Efforts are needed to investigate the effects of repeated headers on children (in line with the new guidelines introduced), as evidence shows the developing brain may be more susceptible to long-term damage than an adult brain following mild brain injury.¹⁴ While purposeful heading should not be confused with mild brain injury, young brains may be more susceptible to any potentially negative effects (if they exist) of repeated heading. It is hoped that by investigating the effects of headers on children's neurodevelopment and any potential adverse clinical outcomes, the maximal safe 'dose' (eg, total number of head impacts over a period) can be more accurately elucidated and risk factors identified (eg, height, strength, position played), to inform guidelines and assist support staff to protect their players. As with adults, potential alterations to the game may further improve safety, such as reducing the weight of balls at all ages during training, ensuring correct size and pressure of balls are used, limiting 'long balls' in training and improving technique of aerial competitions.

This will allow guidelines to be adapted to ensure that the pleasure and health benefits of participation in the sport are maximised, the fabric of the sport is not unnecessarily interfered with, and the safety of the participants is preserved among concerns with uncertain evidence. Despite the preponderance of data relating to the effect of concussion from studies of American Football players, there is comparatively little in football players, making it difficult for governing bodies to recommend sweeping policy change.

What about the playground?

Football is a mass participation sport, with the majority of children and young people playing football 'informally' in schools, parks and fields. Here, there will be no record of the number of head impacts players receive and no coach preventing players from heading the ball more frequently than the guidelines recommend.

Meaningful research

Studies that investigate the acute effect of head impacts in football often have low participant numbers (ie, <20^{12, 13}), limiting generalisability. More research is therefore required to differentiate any potential harm to players from accidental head impacts, head acceleration events, and purposeful heading.

¹Clinical Research Division, Alder Hey Children's NHS Foundation Trust, Liverpool, UK

²Research Institute for Sport and Exercise Science, Liverpool John Moores University, Liverpool, UK

³Bishop Heber High School, Malpas, UK

⁴University of Leeds, Leeds, UK

⁵Medical Department, Liverpool Football Club, Liverpool, UK

⁶Department of Women's and Children's Health, University of Liverpool, Liverpool, UK

Correspondence to Professor Daniel B Hawcutt; d.hawcutt@liverpool.ac.uk

The goal of researching the potential neurological harms from the repetitive head impacts associated with playing football, and any subsequent change to current training and competition guidelines, is not to dissuade young people from playing the sport. The goal is to better understand the difference between purposeful heading and concussion or other forms of non-concussive head impact (eg, head-to-head collisions) and to elucidate factors that may exacerbate one's risk of developing neurological impairments. Indeed, it is quite possible that the concerns regarding repetitive heading in football are fuelled by fears of long-term neurological damage and not validated by empirical evidence. As researchers and clinicians, we must be mindful of the plethora of societal benefits participation in team sports brings in terms of improved cardiovascular and mental health, avoidance of obesity, social interactions and more. Unfortunately, awareness of unproven risks associated with heading is already of public concern, and there is potential that families will assume the worst and football will suffer. Our view, therefore, is that without quality research, it will not be possible to provide a comprehensive risk-benefit assessment that ensures evidence-based rules can be developed (if required) without compromising the safety and enjoyment of the world's most popular sport.

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ORCID iD

Shaun Sutehall <https://orcid.org/0000-0003-3363-7975>

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