ISRCTN44241334 https://doi.org/10.1186/ISRCTN44241334

The effect of football heading on blood biomarkers of brain injury

Submission date
09/09/2025

Recruitment status
No longer recruiting

Registration date
11/09/2025

Overall study status
Completed

Last Edited
11/09/2026

Condition category
Nervous System Diseases

[X] Prospectively registered
[_] Protocol
[X] Statistical analysis plan
[_] Results
[_] Individual participant data
[X] Record updated in last year

Plain English summary of protocol
Background and study aims
This study will explore how heading a football affects markers of brain health in the blood. We know that professional footballers have a higher risk of developing dementia and other brain diseases later in life, but the role of heading the ball in this process is not fully understood. This study aims to investigate whether a single session of controlled football heading causes short-term changes in blood markers linked to brain injury. These biomarkers are proteins that can be measured in blood samples and may reflect damage to brain cells. By testing these biomarkers at several timepoints after heading, we will examine the short-term time course of the biological effects of heading.

Who can participate?
Healthy adult volunteers who regularly play football and have experience with heading can take part in this study. Both men and women can participate. People with recent head or neck injuries, neurological or psychiatric conditions, or other health problems that could interfere with the study will not be eligible.

What does the study involve?
In this study, volunteers will take part in two sessions: one where they perform a set number of headers with a football, and another where they do not. Blood samples will be taken at several timepoints (before heading [baseline] and after 30 minutes and 2, 4 and 24 hours) in the heading session and matched timepoints in the control session. These samples will be tested for proteins linked to brain cell damage. Participants will also have their vision and symptoms assessed. The researchers will also use computer simulations to model the forces experienced by the head during heading.

What are the possible benefits and risks of participating?
This study will not provide direct medical benefit to participants. However, participants will contribute to important research that may help us better understand the effects of heading on brain health and inform safer sporting practices. The risks of participation are low. Only indiviuals with experience of football heading will be recruited. All laboratory procedures will be carried out by trained staff and safety will be carefully monitored.

Where is the study run from?
The study is being run from the University of Stirling in collaboration with the University of Edinburgh (UK)

When is the study starting and how long is it expected to run for?
December 2023 to September 2026

Who is funding the study?
The study is supported by Medical Research Scotland and the RS Macdonald Facility Access run by SULSA and SINPASE. The funders will have no role in study design or analysis.

Who is the main contact?
Magdalena Ietswaart, mi9@stir.ac.uk

Contact information

Type(s)
Public, Scientific, Principal investigator

Contact name
Dr Magdalena Ietswaart

Contact details
University of Stirling
Stirling
United Kingdom
FK9 4LA
+44 (0)1786 473171
mi9@stir.ac.uk

Type(s)
Public, Scientific

Contact name
Mr Syed Ali Muqtadir

ORCID ID
https://orcid.org/0000-0002-1361-1041

Contact details
University of Stirling
Stirling
United Kingdom
FK9 4LA
+44 (0)1786 473171
sam24@stir.ac.uk

Type(s)
Public, Scientific

Contact name

Mr Thomas Aston

Contact details
University of Edinburgh
Edinburgh
United Kingdom
EH9 3JL
+44 (0)131 650 1000
thomas.aston@ed.ac.uk

Type(s)
Public, Scientific

Contact name
Prof Colin Moran

Contact details
University of Stirling
Stirling
United Kingdom
FK9 4LA
+44 (0)1786 473171
colin.moran@stir.ac.uk

Additional identifiers

Protocol serial number
NICR 2024 11040 13581

Study information

Scientific Title
Acute temporal dynamics of plasma biomarkers following a controlled football heading paradigm

Study objectives
Investigate the acute effects of controlled football heading on blood plasma biomarkers of neuronal and glial injury (NfL, GFAP, UCH-L1, BD-Tau) compared to a no-activity control condition. This study aims to characterise the temporal dynamics of biomarker release across five serial sampling timepoints (pre-heading, post-30 min, 2 h, 4 h and 24 h).

Ethics approval required
Ethics approval required

Ethics approval(s)
Approved 25/05/2024, NHS, Invasive or Clinical Research Panel (NICR) (University of Stirling, Cottrell 3B1, Stirling, FK9 4LA, United Kingdom; +44 (0)1786 473171; nicr@stir.ac.uk), ref: NICR 2024 11040 13581

Primary study design

Interventional

Study design
Within-subject repeated-measures experimental design

Study type(s)
Other

Health condition(s) or problem(s) studied
Risk-factors for long-term neurodegenerative disease associated with repeated subconcussive head impact exposure

Interventions
Each participant will undergo two conditions (Heading and Control) separated by at least 7 days. In the heading condition, participants will perform a controlled series of 10 rotational football headers using a ball launcher. For the Control condition, the sampling points will be matched to the Heading condition. All participants will complete both conditions with participants serving as their own controls. Condition order will be counterbalanced across participants.

Intervention Type
Other

Primary outcome(s)
Plasma concentration of Neurofilament Light (NfL), Glial Fibrillary Acidic Protein (GFAP), Ubiquitin C-terminal Hydrolase L1 (UCH-L1), and Brain-Derived Tau (BD-Tau) measured using the Quanterix Simoa Neurology 4-plex D assay on a Simoa HD-X Analyzer at pre-determined timepoints (pre-heading [baseline] and post-30 min, 2 h, 4 h, and 24 h) in the Heading session and matched timepoints in the Control condition.

Key secondary outcome(s)
1. Near Point of Convergence (NPC) measured using an accommodative ruler at Pre-heading and at 0 h, 30 min, 2 h, 4 h, and 24 h post-intervention
2. Symptom evaluation and cognitive function measured using the Sport Concussion Assessment Tool (SCAT6) at Pre-heading and 0h, and 24 h post-intervention
3. Linear and rotational head acceleration measured at each head impact during the Heading condition.
4. Anthropometric measures (height, weight, neck circumference, head circumference, grip strength) measured using standardised equipment at a familiarisation session
5. Finite Element Head Model (FEHM) estimates of brain tissue strain and stress derived from recorded impact kinematics for each heading impact during the Heading condition

Completion date
30/09/2026

Eligibility

Key inclusion criteria
1. Healthy adult football players that participate in footballing activity of a regular basis (at least once a week)
2. Confirm to normally head the ball in football practice or match scenarios

Participant type(s)
Healthy volunteer

Healthy volunteers allowed
Yes

Age group
Mixed

Lower age limit
18 Years

Upper age limit
65 Years

Sex
All

Total final enrolment
14

Key exclusion criteria
1. Neurological or psychiatric conditions
2. Are currently taking or in withdrawal of recreational drugs or certain prescribed drugs
3. Consumption of >3u alcohol in the 24 hours prior to testing (self-reported)
4. Excessive intake of caffeinated drink in the hours prior to assessment (self-reported)
5. Recently (i.e. less than 6 months prior to testing) experienced trauma to the head (concussion, loss of senses, any type of brain injury)
6. Position the individual plays in the squad (goalkeepers and players who do not regularly head the ball are not eligible to take part)

Date of first enrolment
16/09/2025

Date of final enrolment
31/07/2026

Locations

Countries of recruitment
United Kingdom

Scotland

Study participating centre
University of Stirling
Stirling Campus
Stirling

Scotland
FK9 4LA

Study participating centre
University of Edinburgh
Old College
South Bridge
Edinburgh
Scotland
EH8 9YL

Sponsor information

Organisation
University of Stirling

ROR
https://ror.org/045wgfr59

Funder(s)

Funder type
Charity

Funder Name
Medical Research Scotland

Alternative Name(s)
Medical Research Council (MRC), Medical Research Scotland, Scottish Charity, MRS

Funding Body Type
Private sector organisation

Funding Body Subtype
Trusts, charities, foundations (both public and private)

Location
United Kingdom

Funder Name

SINAPSE

Funder Name
SULSA

Results and Publications

Individual participant data (IPD) sharing plan
Committed to open science, the data-sharing plans will be made available at a later date.

IPD sharing plan summary
Other

Study outputs

Output type	Details	Date created	Date added	Peer reviewed?	Patient-facing?
Statistical Analysis Plan	version 2		30/01/2026	No	No