introducing injury prevention measures. Males are more frequently exposed than females, heading rates increase with age, and there is substantial variation between players. Heading is a rare event in the youngest age groups, especially among females.

014 HEAD IMPACT DOSES AND 'NO-GO' DEFICITS IN OLYMPIC AND NON-OLYMPIC SPORT ATHLETES

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Background The relationship between head impact dose and observable functional deficits remains unclear. While studies have almost exclusively examined American football athletes, in Olympic athletes there are almost no data that explore this relationship.
Objective We aimed to use an impact monitoring mouthguard (IMM) to quantify head impact doses in Olympic and non-Olympic Sports, identifying high-energy impacts on video as 'No-go' per the NFL protocol.
Design Retrospective meta-analysis from American football, basketball, boxing, ice hockey, karate, lacrosse, mixed martial arts, rugby, tae-kwon-do, soccer.
Setting Sporting field
Patients (or Participants) 4500 impacts over 800 player-games.
Interventions (or Assessment of Risk Factors) Impact doses where the athlete was observed as 'no-go'.
Main Outcome Measurements Kinetic energy transfer (KE), risk-weighted exposure (RWE), peak scalar linear acceleration (PLA), peak scalar linear velocity (PLV), peak scalar angular acceleration (PAA), peak scalar angular velocity (PAV), impact location, impact direction, 'No-go' status.
Results The median KE, RWE, PLA, PAA, PLV and PAV was 5 J, 0.0002, 20 g, 1500 rad/s^2, 10 rad/s and 1.5 m/s, respectively. American football athletes sustained the highest energy impact doses, boxers and mixed-martial artists sustained the highest cumulative dose for a day of competition. Ice hockey had the highest rate of 'no-go' impacts versus total impacts collected. Karate had the highest rotational kinematics. Of the nine (9) highest energy impacts to the side and rear of the head, all were 'no-go' impacts. Of the top eight (8) highest energy impacts to the front of the head, none were 'no-go' impacts.
Conclusions 'No-go' observations occurred in high energy impact doses to the rear and the sides of the head, while similar impact doses to the forehead seemed tolerable. Prospective Olympic athlete impact monitoring could help identify risky exposures.

015 BIOMARKERS IN SERUM AFTER HEAD IMPACT EXPOSURE IN FOOTBALL

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Background The link between head-impact exposure in football and neurological sequelae remains controversial. Blood-based biomarkers can provide valuable information in traumatic brain injuries, reflecting e.g. axonal damage.
Objective To investigate if repetitive headers or accidental head impacts in football could cause structural damage to the brain, detected as an increase in serum concentrations of neurofilament light (NfL) or tau proteins.
Design Prospective cohort study.
Setting Elite division football.
Participants Male football players in the Norwegian premier league, including a total of 621 player seasons.
Independent Variables Short- and long-term exposures in football, with and without head impacts.
Main Outcome Measurements Baseline NfL and tau were measured in Norwegian professional football players in pre-season. Then, the effect of short-term exposures (independent variable) was assessed by measuring biomarker levels (dependent variable) after three conditions: (1) high-intensity exercise, (2) repetitive headers, and (3) head-impact incidents in a match. The effect of long-term head impact exposure was assessed by comparing two groups with relative differences in previous concussions and headers at baseline (low vs. high levels).
Results We analyzed 354 samples. Mean (±SD) NfL concentration was 6.8±2.6 pg/mL; mean tau concentration was 1.2±0.7 pg/mL. We observed no short-term effects on NfL after exposure from either of the three conditions. Tau levels rose in response to high-intensity exercise and repetitive headers, but not after accidental head-impact incidents; the highest absolute values were seen 1 h after high-intensity exercise. We did not detect any long-term effects on serum NfL or tau concentrations from previous concussions and headers.
Conclusions NfL and tau in serum were unaffected by head impacts in football, after both short-term and long-term exposure. Importantly, tau levels seem to rise in response to exercise, emphasizing the need for appropriate control groups in future studies. Our findings highlight important characteristics and limitations for using NfL and tau as biomarkers in sports.

016 TACKLE CHARACTERISTICS ASSOCIATED WITH CONCUSSION IN BRITISH UNIVERSITY LEVEL RUGBY UNION

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