INTRODUCTION

- There are between 1.6-3.8 million sports related concussions each year in The United States, many come from American football.¹
- Of American football players, youth participants (ages 8-12) are nearly twice as likely to sustain a concussion than high school players and nearly 3 times as likely when compared to professional NFL players.¹
- Increased technology employed in football helmets has more than doubled their weight in the last 30 years; yet the effect of this added weight on concussion risk in youth players is still unknown.²
- This study sought to correlate the effect of increased head mass with concussion risk in youth football players.
- A laboratory setting was used to investigate how varying the overall mass of a helmeted anthropomorphic test device (ATD) headform affects injury criteria values related to concussion risk, namely the Head Injury Criteria (HIC) and Brain Injury Criteria (BrIC).

MATERIALS & METHODS

- A pneumatic ram weighing 23.9 kg was used to impact a helmeted ATD headform at 3 speeds (2.5, 3.75, 5 m/s) and 5 locations (front, front-oblique, side, rear-oblique, rear).
- A 10-year old Hybrid III ATD wore three different youth helmets of varying weight and padding design (see table 1). A human hair wig was placed on the ATD to simulate a realistic head interface. The ATD headform was attached to a Large Omni-Directional Child (LODC) neck, a biofidelic neckform, which allows for 90° of free rotation in the transverse plane.³

RESULTS & DISCUSSION

- Averaging across all helmets, impact speeds and impact directions, a 0.66 kg increase in head mass caused a 3.5% decrease in HIC values and a 2.3% decrease in BrIC values.

- Increases in weight caused increases in injury criteria values for the F-Oblique impact direction. Increases in weight caused decreases in injury criteria values for Front, and Rear impact directions.

- Increases in weight caused decreases in injury criteria values for the Schutt helmet and lower speeds (2.5, 3.75 m/s), slight increases in injury criteria values were observed at higher speeds.

- Weight did not have a significant main effect, however, it was involved in several significant interaction effects.

- On average, the Riddell helmet performed the best over all speeds and impact directions.

REFERENCES CITED


CONCLUSIONS

- Overall, increases in head mass did not significantly effect concussion risk based on HIC & BrIC injury criteria. However, in Front-Oblique impacts, increases in weight correlated with increases in concussion risk for both HIC and BrIC criteria.

- Helmet-to-helmet comparison was highly dependent on the impact location being tested.

- Future work includes repeat testing of vulnerable locations (Front-Oblique & Rear), eccentric impacts, and the addition of weight not centered at the headform CG.

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