

# THE EFFECT OF COACHING AND PLAYER POSITION ON HEAD IMPACT EXPOSURE IN YOUTH FOOTBALL PLAYERS

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## ABSTRACT

Youth football players comprise almost 70% of the football playing population, and the ongoing development of these athletes makes the understanding of concussions and repetitive head impact exposure in this population of particular concern. The objective of this study was to determine how player position and coaching influence head impact exposure in youth football players while controlling for player age. This analysis focused on a cohort of 45 youth football players between the ages of 9 and 14 that had helmets instrumented with accelerometer arrays for at least two seasons. A repeated measures, mixed model was used to assess the effect of coach and position on impacts per session, 95<sup>th</sup> percentile linear acceleration, and 95<sup>th</sup> percentile rotational head acceleration. Head impact exposure was also modeled in aggregate and for practices and games independently. Player position and coach were observed to be significant factors related to head impact exposure. These data highlight the important role that coaches have in managing head impact exposure for teams they lead.

**Keywords:** acceleration, linear, rotational, concussion, biomechanics

## INTRODUCTION

Sports-related concussion has recently become a public health concern, with estimates of as many as 1.9 million sports-related concussions occurring in youth athletes annually [1]. While often thought of as a transient injury, recent research has suggested an association between concussion and potential long-term symptoms and neurodegeneration [2, 3]. It has even been suggested that sub-concussive head impact exposure due to participation in football might be associated with neurocognitive or brain changes [4, 5]. Given that younger populations are still undergoing brain development, youth athletes represent a potentially more vulnerable population compared to adult football players [6-9].

Head impact exposure research has been quantified in youth football players recently and shed light on how impact magnitude and frequency increase with player age [10-12]. Factors, like coaching style and player position, have been found to be associated with differences in head impact exposure through aggregate analyses [13]. Furthermore, head impact exposure and concussion tolerance seem to vary greatly at the individual level [14]. This study is unique because it controls for variation between players through repeated measures analysis.

The objective of this study was to model head impact exposure in youth football players by assessing the contributions of factors thought to relate to head impact exposure. Head impact exposure was characterized for each individual athlete-season by 95<sup>th</sup> percentile linear and rotational resultant head impact accelerations and head impact rate, calculated on a per session basis. In this analysis, player age, position, and coach were modeled as factors. We hypothesized that coach effects would be related to exposure measures in practices, while effects due to player position would be attributed to game-related head impact exposure.