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### Original Research

## Sex Differences in Head Acceleration During Heading While Wearing Soccer Headgear

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### Abstract

**Context:** Researchers have indicated that female soccer players may be at greater risk of concussion compared with their male counterparts. Soccer headgear is marketed for reducing head acceleration and risk of concussion.

**Objective:** To determine the effect of sex and soccer headgear on head impact kinematics and dynamic stabilization during soccer heading.

**Design:** Cross-sectional design.

**Setting:** Research laboratory.

**Patients or Other Participants:** Forty-four college-aged soccer players (29 women, 15 men).

**Intervention(s):** Using a head impact model, participants performed 4 soccer headers under 3 headgear conditions (control, Head Blast Soccer Band, and Full90 Select Performance Headguard).

**Main Outcome Measure(s):** Dependent variables assessed before soccer heading were head-neck anthropometrics and isometric neck muscle strength, and those assessed during soccer headers were resultant linear head acceleration, Head Injury Criteria (HIC<sub>36</sub>), and superficial neck muscle electromyography. Statistical analyses included multivariate and univariate analyses of variance with repeated measures, independent-samples *t* tests, appropriate follow-up analyses of variance and post hoc *t* tests, and Pearson product moment correlations ( $\alpha = .05$ ).

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**Results:** Head acceleration in women was 32% and 44% greater than in men when wearing the Head Blast (21.5 g versus 16.3 g) and Full90 Select (21.8 g versus 15.2 g), respectively ( $P < .05$ ). Compared with men, women exhibited 10% greater head accelerations (20.2 g versus 18.2 g) during the control condition ( $P = .164$ ).

**Conclusions:** Female soccer players exhibited greater head accelerations than their male counterparts when wearing headgear. Our results are important clinically because they indicate that soccer headgear may not be an appropriate head injury prevention tool for all athletes.

**Keywords:** [head impact kinematics](#), [concussion pathomechanics](#), [brain injuries](#), [football players](#)

Ryan T. Tierney, PhD, ATC, contributed to conception and design; acquisition and analysis and interpretation of the data; and drafting, critical revision, and final approval of the article. Michael Higgins, PhD, PT, ATC, and Shane V. Caswell, PhD, ATC, contributed to conception and design; analysis and interpretation of the data; and drafting, critical revision, and final approval of the article. Jessica Brady, MEd, ATC, and Krista McHardy, MEd, ATC, contributed to conception and design; acquisition and analysis and interpretation of the data; and drafting, critical revision, and final approval of the article. Jeffrey B. Driban, PhD, ATC, CSCS, contributed to conception and design; acquisition and analysis and interpretation of the data; and drafting, critical revision, and final approval of the article. Kurosh Darvish, PhD, contributed to analysis and interpretation of the data and drafting, critical revision, and final approval of the article.

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