



Neuroprotective Effect of Omega-3 Fatty Acids on Head Trauma in American Football Athletes

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ABSTRACT

Repetitive head impacts sustained over the course of an American football season, even in the absence of a concussion diagnosis, results in a quantifiable pathophysiological response. Further, long-term exposure to repetitive head impacts may lead to neurological impairment, including the development of neurodegenerative disease. Prophylactic treatment with the omega 3 fatty acids (n-3FA) eicosapentaenoic (EPA) and docosahexaenoic (DHA) attenuates the pathophysiological response to head trauma in rodent models. **PURPOSE:** The purpose of this study was to examine the effect of n-3FA supplementation on a blood biomarker of head trauma over the course of an American football season. **METHODS:** Two National Collegiate Athletic Association American football teams volunteered for the study. Thirty-one athletes (n = 31) on one team ingested a highly bioavailable, proprietary formulation (Mindset®), containing n-3FA, including DHA (2,000 mg), EPA (560 mg), and 320mg docosapentaenoic acid (MS-Ω), over the course of an entire season. Thirty-three athletes (n = 33) from the other team served as the control. Neurofilament light (Nf-L), a biomarker of axonal injury, was measured in blood samples obtained prior to the start of the season (T1), at the end of pre-season camp (T2), and over the course of the season (T3 – T6). Standardized magnitude based inference was used to define outcomes of interest. **RESULTS:** Relative to the control group (12.4 ± 5.3 pg•mL⁻¹), MS-Ω very likely attenuated Nf-L measured at the conclusion of Fall camp (8.9 ± 4.5 pg•mL⁻¹) (mean; ×/÷90% confidence limits; 1.5; ×/÷1.2 fold), a period of significant contact. Further, the attenuation relative to placebo was likely maintained at T3 (1.3; ×/÷1.2 fold), T4 (1.3; ×/÷1.2 fold), T5 (1.3; ×/÷1.3 fold), and T6 (1.2; ×/÷1.3 fold) corresponding to sampling time points during the competitive season. **CONCLUSION:** These data indicate that over the course of the season the head trauma sustained by American football athletes does result in a quantifiable pathophysiological response as measured by a biomarker of axonal injury. Further, administration of MS-Ω may impart neuroprotective qualities as evidenced by lower levels of Nf-L. **FUNDING:** This study was funded in part by STRUCT Nutrition, Missoula, MT, USA.

BACKGROUND

- Secondary to participation in American football, athletes are routinely subject to repetitive head impacts (RHI).
- Though estimated that between 1.1 and 1.9 million sports- and recreation-related concussion occur annually in young athletes, those statistics do not reflect those athletes participating in contact sports who are exposed to RHI but do not sustain a clinically evident concussion (i.e., those impacts that do not result in identifiable functional disturbances or symptoms).
- There is a growing body of evidence linking subconcussive RHI sustained by contact-sport athletes to the development of the neurodegenerative disorder, chronic traumatic encephalopathy (CTE).
- The accumulation of subconcussive RHI acquired over the course of a competitive season of contact-sport participation, even in the absence of overt functional disturbances or a clinically diagnosed concussion, results in quantifiable microstructural and functional changes in the brain.

BACKGROUND CONT.

- Recent work by our laboratory group indicates that the quantification of the axon-specific intermediate filament, neurofilament light polypeptide (Nf-L), may be useful for detecting the neurological damaged linked to RHI sustained during a season of collegiate American Football.
- Thus, strategies to protect athletes from the potential long-term effects of contact-sport induced RHI must be explored.
- In animal models of head injury, prophylactic supplementation with n-3FA, attenuates damage induced by experimental injury.
- Recognizing the potential neuroprotective effect of n-3FA administration was the foundation of the current study.

PURPOSE

The purpose of this study was to examine the effect of n-3FA supplementation on a blood biomarker of head trauma over the course of an American football season.

METHODS

- This study used a multi-site, non-randomized study design.
- Blood was obtained from participants at various time points throughout the course of the study (**Figure 1**).

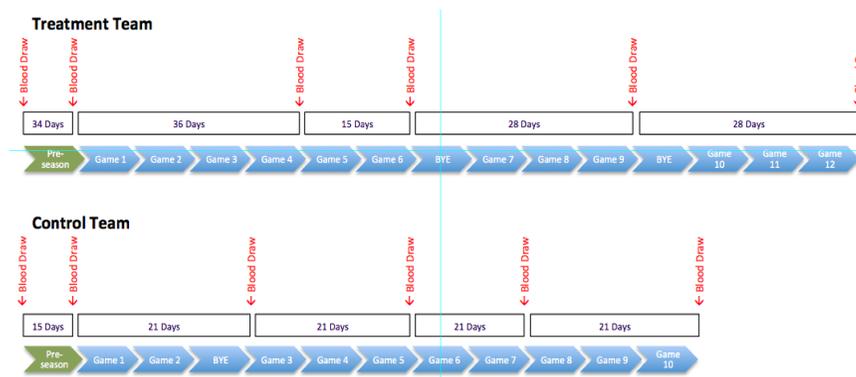


Figure 1. Blood draw timeline for treatment and control team

- A consort diagram is provided in **Figure 2**, outlining the reasons for dropout and/or exclusion.
- Compliance over the course of the study was 93%.
- The treatment teams received a daily supplement of n-3FA consisting of 2000 mg of docosahexaenoic acid (22:6, n-3; DHA), 560 mg of eicosapentaenoic acid (20:5, n-3; EPA), and 320 mg of docosapentaenoic acid (22:5, n-3; DPA) (MS-Ω) for the duration of their 2016 American football season for a total of 89 days of supplementation.
- The effects of supplementation and time on variables of interested were calculated from a mixed model ANOVA.
- From that model, estimates and uncertainty of the large-sample effect were derived to allow for a magnitude-based approach to inference.

METHODS CONT.

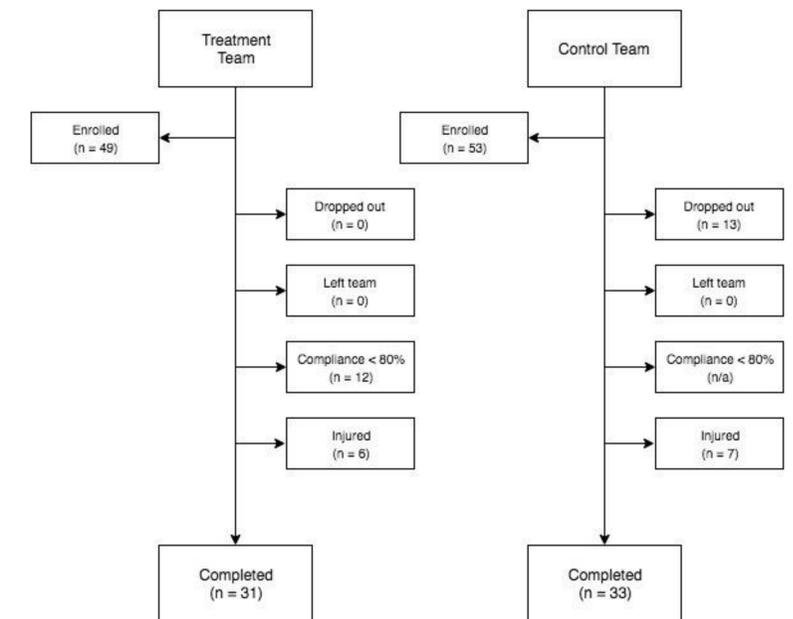


Figure 2. Consort diagram

RESULTS

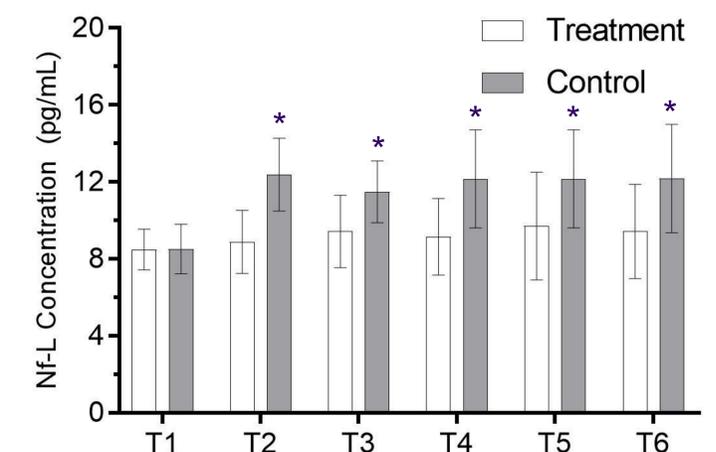


Figure 3. Biomarker concentration by time point

- MS-Ω supplementation very likely attenuated Nf-L concentrations at the conclusion of fall camp, which was likely maintained at T3-T6 during the competitive season.

CONCLUSION

- Supplementation with the DHA, EPA, and docosapentaenoic acid supplement MS-Ω, attenuates serum Nf-L during periods of high contact throughout an entire season of American football.