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Jacobs School of Medicine and Biomedical Sciences
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Nutrition and Energy Expenditure of Retired Professional Contact Sport Athletes and Non Contact Sport Controls

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Abstract

Little is known about the dietary patterns and lifestyle of retired athletes. To compare the physical health, diet, and Estimated Energy Expenditure (EEE) of male retired professional contact sport athletes with healthy, age-matched, non-contact sport athlete controls, subjects completed the Yale Physical Activity Survey and the Food Frequency Questionnaire. Contact Athletes (n = 21, 56.3 ± 10.9 years, 29.7 ± 3.6 kg/m^2) were significantly more overweight (n = 21, 56.7 ± 9.5 years, 24.5 ± 2.6 kg/m^2, $p < 0.001$). Calculated kilocalorie intake was not significantly different; however, the total time spent doing common types of physical activities was significantly lower in retired contact sport athletes (22.5 ± 18.7 hrs/wk vs 51.1 ± 15.0 hrs/wk, $p < 0.001$). Intake of many brain healthy micronutrients, including copper ($p = 0.019$), selenium ($p = 0.037$), folate ($p = 0.02$), manganese ($p = 0.002$), and riboflavin ($p = 0.047$) was significantly lower in retired contact sport athletes (n=12) when compared to controls (n=21).

Background

Mild traumatic brain injury (mTBI) is a common injury that many National Football League (NFL) and National Hockey League (NHL) athletes suffer from repeatedly throughout their training and careers. It is thought that repeated mTBI through out life may lead to the development of Chronic Traumatic Encephalopathy (CTE)[1]. CTE is a progressive neurodegenerative disorder characterized by the deposition of hyper-phosphorylated tau (p-tau) protein within the brain[2]. The etiology of CTE is suspected to come from repetitive concussive or sub-concussive blows to the head, similar to those received while playing sports with extensive physical contact[3].

Although it is agreed that post mortem neuropathological analysis is currently the only way to definitively diagnose CTE[4], there is controversy surrounding a clinical detection[5]. Although there has been extensive research surrounding other causes for neurodegeneration including cardio-vascular risk and cognitive reserve[6-8], little attention has been given to athletes' nutritional habits and general lifestyle. There are many components that can lead to degradation and aging of the brain, including the possible lacking of vitamins and minerals in the diet as well as the decline of regular activity. The purpose of this study was to evaluate other causes of cognitive decline in retired contact sport athletes, specifically micronutrients and physical activity, and compare them with an age-matched, non-contact sport athletic control population.

Funding

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Methods

We contacted and recruited through local National Football League (NFL) and National Hockey League (NHL) alumni associations retired professional contact sport athletes (CS). Male non-contact sport athlete controls (NS) were recruited by contacting athletic clubs with rosters that included older athletes. The following validated, self-reported questionnaires were filled out to get an estimate of micronutrients found in their diet and the amount of physical activity they perform on a regular basis (Estimated Energy Expenditure, EEE), respectively:

1. Food Frequency Questionnaire (FFQ)
2. Yale Physical Activity Survey (YPAS)

Analysis of variance was used to examine group differences in demographics, individual micronutrient intake, and energy expenditure. P-values < 0.05 were considered significant.

Participant

Criteria for Inclusion

Contact Sport Athlete	Non-Contact Sport Athlete
Played a professional contact sport for two or more seasons	Athletes who participated in individual non-contact sport
Currently retired	No history of self-reported or documented concussions
Between the ages of 36-72 years	Between the ages of 36-72 years

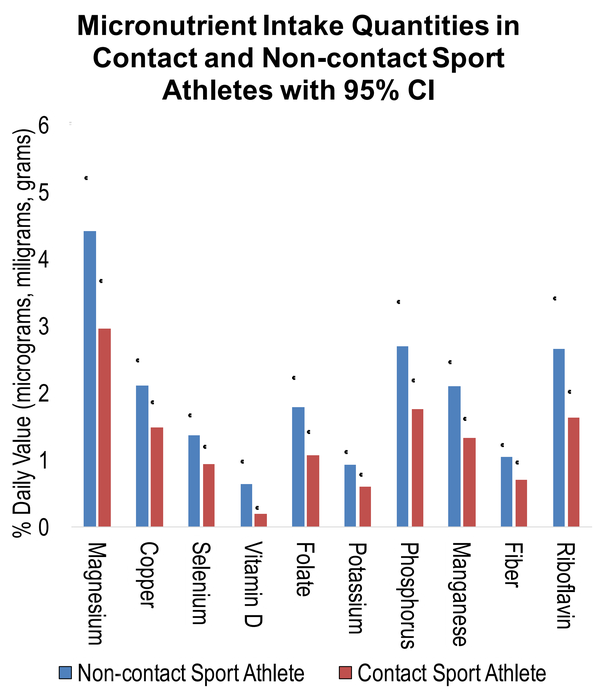
Participant Demographics and Macronutrients

	Contact Sport	Non-contact Sport	P Value
Age (years)	56.3 ± 10.9	56.7 ± 9.5	0.893
BMI (kg/m^2)	29.7 ± 3.6	24.5 ± 2.6	< 0.001
FFQ Sample Size	N = 12	N = 21	-
YPAS Sample Size	N = 21	N = 21	-
LDL Cholesterol (mg/dL)	106.9 ± 39.1	103.3 ± 32.7	0.753
HDL Cholesterol (mg/dL)	42.6 ± 7.7	49.8 ± 10.9	0.017
Average Daily Intake (kCal)	1944.3 ± 806	2602 ± 1360	0.138
Carbohydrate (%)	43.8 ± 8.4	46.7 ± 7.7	0.319
Protein (%)	15.5 ± 2.7	15.3 ± 2.4	0.814
Fat (%)	35.6 ± 6.9	34.6 ± 8.3	0.718

Values expressed as Mean ± SD

Results

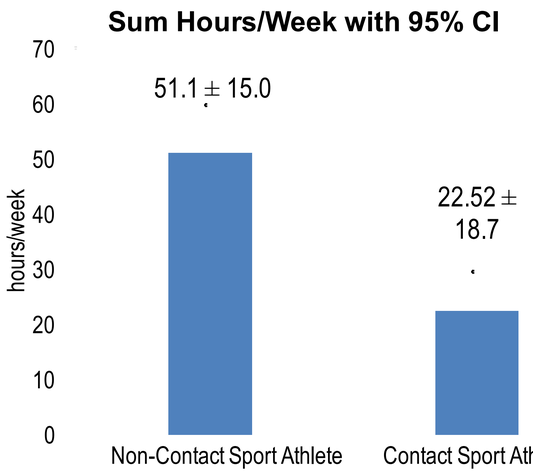
Figure 1. Micronutrient with significant differences in intake quantities between groups



Magnesium ($p = 0.013$) and Fiber ($p = 0.02$) are in grams
Copper ($p = 0.019$), Potassium ($p = 0.02$), Phosphorous ($p = 0.043$), Manganese ($p = 0.002$), and Riboflavin ($p = 0.047$) are in milligrams
Selenium ($p = 0.037$), Vitamin D ($p = 0.035$), and Folate ($p = 0.02$) are in micrograms

Non-significant micronutrients from FFQ included Vitamin A, C, E, and K, Zinc, Thiamin, Sodium, Iron, Chromium, Molybdenum, Calcium, Niacin, Pyridoxine, and Cobalamin.

Figure 2. Sum of Hours Spent Doing Activities/Week



Sum of hours spent doing activities/week from Yale Physical Activity Survey. Retired Athlete values were significantly different than control values, $p < 0.05$

Discussion and Conclusion

Several of these micronutrients, which were significantly lower in retired contact sport athletes than age-matched non-contact sport athletes, are associated with brain health. Studies have shown that lower plasma copper levels have been linked to cognitive decline.[9] Manganese influences synaptic neuro-transmission, low levels have been proven to lead to neuro-deficiencies.[10] Selenium's effect on brain health is not very clear, but a previous study has shown that it may help improve neurologic function after suffering a TBI.[11] Numerous studies have shown that higher rates of folate intake correlate to faster cognitive decline.[12] Whereas the correlation between decreased cognition and decreased Vitamin D after traumatic brain injury have been reported,[13] there is no evidence that supplementation will lead to improved cognition.[14]

While the values of these micronutrients, as well as others, met statistical significance, future studies should be performed with larger sample sizes. Although the FFQ is a validated measure to help determine the user's specific nutrient quantities intake, there may be some discrepancies in whether the data actually reflects a user's diet due to recall bias. The discrepancy in sample size is due to several CS subjects not filling the FFQ out correctly, which could suggest a confounding variable. The YPAS also demonstrated that, while neither group is obese, the retired athlete group is significantly more overweight and spend significantly less time performing physical activities per week.

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