The Exploration of Dietary Habits Associated with Healthy Brain Functioning Across the Lifespan

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Introduction

The Healthy Brain Project (HBP) is a unique study at the Brain Sciences Center that integrates neuroimaging, genetics, cognitive, and lifestyle data in order to identify characteristics associated with healthy brain aging [1]. Participants are cognitively healthy women veterans from ealty adulthood to advanced old age. **Collecting such data from a healthy population could allow for more detailed identification of dietary habits associated with healthy brain function across the lifespan.**

Methods

Nutritional data

In collaboration with the Medical Center's Nutrition and Food Service, we have collected detailed nutritional information from each participant, since nutritional status can have a major effect on brain functioning. Participants were asked to prepare food journals by recording food and beverage intake for three days, two weekdays and one weekend day. The items were then entered into Nutritionist Pro Version 6 software for further analysis. Using this software, we were able to quantify a over 100 of macro and micro-nutrients, including amino acids, trace minerals, and lipids, as shown below.

Cognitive status

Cognitive status was assessed using the Montreal Cognitive Assessment (MoCA) and, more extensively, by the 3MS battery. The analyses below were carried out on 83 women (age range 24-98 y) with total MoCA scores > 25.

Energy	Kilocalories
Nutrients (total)	Protein, Carbohydrates, Fat
Lipids	Cholesterol, Saturated Fat, Monounsaturated Fat,
	Polyunsaturated Fat, Oleic Acid, Linoleic Acid,
	Linolenic Acid, EPA, DHA, Trans Fatty Acids
Minerals	Sodium, Potassium, Calcium, Iron, Iodine, Magnesium,
	Zinc, Copper, Manganese, Selenium, Fluoride, Chromium, Molybdenum
Vitamins	Vitamin A, Beta Carotene, Alpha Carotene,
	Lutein Zeaxanthin, Beta Cryptoxanthin, Lycopene,
	Vitamins C, D, E, Alpha tocopherol, Thiamin, Riboflavin,
	Niacin, Pyridoxine, Folate, Cobalamin, Biotin,
	Pantothenic Acid, Vitamin K
Fiber	Dietary Fiber, Soluble, Insoluble, Crude
Sugars	Total, Glucose, Galactose, Fructose, Sucrose, Lactose,
	Maltose
Amino acids	Tryptophan, Threonine, Isoleucine, Leucine, Lysine,
	Methionine, Cystine, Phenylalanine, Tyrosine, Valine,
	Arginine, Arginine, Histidine, Alanine, Aspartic Acid,,
	Glutamic Acid, Glycine, Proline, Serine
Moisture	Moisture
Other	Caffeine, Alcohol

Brain function

Brain function was assessed using resting state magnetoencephalography (MEG) [2]. Data were acquired for 1 min (at 1017 Hz) from 248 axial gradiometers. Resulting MEG time series were prewhitened using an ARIMA model and zero-lag crosscorrelated, yielding 30628 correlations. Partial correlations (Synchronous Neural Interactions, SNI [2]) were computed, their absolute value taken as an esimate of the strength of pairwise neural association, and log-transformed to normalize its distribution. We then computed, for each participant, the Coefficient of Variation (CV = Standard Deviation / Mean) which we had previously found to be a good index of neural network "health" [3], in that lower-to-higher CV indicates more-to-less orderly organized network. Finally, we evaluated the effect of the various nutrients above by performing a stepwise multiple linear regression analysis where the dependent variable was the CV and predictors were all the nutrients and the participant's age as a covariate.

Results & Discussion

Preliminary analyses have revealed large variety in participants' intake of several nutrients, which allows for a rigorous, ongoing, exploration of associations with neural functioning. The stepwise multiple linear regression analysis revealed two strong and opposite effects of beta carotene (P=0.00036) and ceta cryptoxanthin (P=0.001): Higher intake of the former was associated with lower CV ("healthier", less-disrupted network), where higher intake of the latter was associated with higher CV. Although preliminary, these results are in general accord with nutritional studies documenting a beneficial effect of beta carotene supplementation in cognitive decline [4]. A thorough analysis of nutrient-brain associations is currently under way in our Center.

References

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