

# Most effective combination of nutraceuticals among multivitamins, zinc, polyphenols, omega fatty acids, and probiotics for improved memory and cognitive performance in *Acheta Domesticus*



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## ABSTRACT

**Statement of the Problem:** Dietary intake of multivitamins, zinc, polyphenols, omega fatty acids, and probiotics have all shown benefits in learning, spatial memory, and cognitive function. It is important to determine the most effective combination of antioxidants and/or probiotics, because regular ingestion of all nutraceuticals may not be practical. The purpose of this study is to examine various combinations of nutrients to determine which may best enhance spatial memory and cognitive performance.

**Methodology & Theoretical Orientation:** Based on the 31 possible combinations of multivitamins, zinc, polyphenols, omega-3 PUFAs, and probiotics, 128 house crickets (*Acheta domesticus* [L.]) were divided into one control group and 31 experimental groups with four house crickets in each group. Throughout 8 weeks, crickets were fed their respective nutrients, and an Alternation Test and Recognition Memory Tests were conducted every week using a Y-maze in order to test spatial working memory.

**Findings:** The highest scoring diets shared by both tests are the combination of multivitamins, zinc, and omega-3 fatty acids (VitZncPuf; Alternation:slope = 0.07226, Recognition Memory:slope = 0.07001), the combination of probiotics, polyphenols, multivitamins, zinc, and omega-3 PUFAs ( ProPolVitZncPuf; Alternation:slope = 0.07182, Recognition Memory:slope = 0.07001), the combination of probiotics, multivitamins, zinc, and omega-3 PUFA (ProVitZncPuf; Alternation:slope = 0.06999, Recognition Memory:slope = 0.07001), and the combination of polyphenols, multivitamins, zinc, and omega-3 PUFA (PolVitZncPuf; Alternation:slope = 0.06873, Recognition Memory:slope = 0.06956).

**Conclusion & Significance:** All of the nutrient combinations demonstrated a benefit over the control diet, but the most significant improvement compared to the control was found in the VitZncPuf, ProVitZncPuf, PolVitZncPuf, and ProPolVitZncPuf. Since this study found no significant difference between the performance and improvement of subjects within these four groups, the combination of multivitamins, zinc, and omega-3 fatty acids (VitZncPuf) was concluded to be the most effective option for improving memory and cognitive performance. These findings suggest potential ways of efficiently using nutrition in dietary strategies to support learning and cognition in humans. This research has implications for food insecurity, as many people lack access to nutritious foods that support learning and cognitive performance. This may be crucial in the context of childhood education, during which barriers to food access could affect learning and thus affect academic outcomes. This study may direct further research developing more detailed nutritional plans for supporting cognition, as well as informing larger-scale changes to be made in food access and mass nutrition to better support childhood learning.

## BIOGRAPHY

Sahithi Madireddy is interested in neuroscience, nutrition, metabolism, cancer biology, and the gut microbiome. Her previous work is centered around the role of nutrition in brain health, particularly in relation to neurodegenerative disorders, such as Parkinson's Disease and Alzheimer's Disease, Amyotrophic Lateral Sclerosis, Huntington's Disease, as well as other neurological disorders. She is also interested in the role of nutrition in the sensitivity of cancer cells to death by ferroptosis.

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