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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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Background: 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 in-gestion of all nutraceuticals may not be practical. This study examines various combinations of nutrients to determine which may best enhance spatial memory and cognitive performance in the house cricket.

Methods: Based on the 31 possible combinations of multivitamins, zinc, polyphenols, omega-3 PUFA, 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.

Results: 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: 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 in the house cricket.

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