Exploring the Impact of Diet on Seizure Susceptibility in Drosophila melanogaster With Mutant Shaker Potassium Channels and Altered Membrane Excitability

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The ketogenic diet is commonly used to prevent seizures in children with drug-resistant epilepsy. However, due to its unpleasant taste and difficulty in adherence, many children must receive it through a feeding tube. This prompted us to investigate whether alternative diets could be just as effective in reducing seizure susceptibility without requiring a feeding tube. To test this, we used Drosophila melanogaster (fruit flies) with mutant shaker potassium channels, which exhibit altered membrane excitability and serve as a simplified model of an epileptic nervous system. We hypothesized that diets rich in omega-3 fatty acids or vitamin B6 could reduce seizure susceptibility, as both nutrients are known to promote brain health. The flies were divided into five groups, each consisting of three vials containing ten flies (five males and five females per vial). The experimental groups were: control, Keppra (an anti-seizure medication), ketogenic diet, omega-3 fatty acid diet, and vitamin B6 diet. Flies were exposed to their respective diets for two weeks. Following the dietary and Keppra treatment times, flies were transferred into vials without anesthesia, and seizures were induced using a water bath set to 40°C. Two metrics were recorded: seizure duration and time to seizure onset. ANOVA analysis revealed a statistically significant decrease in seizure duration ($P < 0.05$) and a significant increase in seizure onset time ($P < 0.05$) for both the Keppra and dietary intervention groups. Post-hoc Tukey testing showed no statistically significant difference ($P > 0.05$) between the Keppra and dietary groups. These results suggest that dietary interventions may effectively reduce both seizure duration and onset and could be as effective as pharmaceutical treatment.

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