The Ketogenic Diet Ameliorates the Effects of Caffeine in Seizure Susceptible Drosophila melanogaster

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Epilepsy is a neurological disease involving spontaneous and chronic seizures. Seizure susceptibility and intensity are affected by a multitude of factors, including caffeine exposure and dietary restriction. Caffeine exposure increases seizure susceptibility, whereas forms of dietary restriction such as the ketogenic diet (KD) decrease it. Other types of dietary restrictions such as low-protein, high-carbohydrate dietary restriction (referred to as DR) mitigate the negative physiological effects of caffeine by decreasing target of rapamycin (TOR) signaling. This study was designed to determine the concurrent effects of caffeine consumption and dietary restriction on seizure susceptible Drosophila melanogaster. Easily shocked (eas) mutant strains were raised on one of three diets (KD, DR, or a standard diet) and were administered caffeine at one of three frequencies (no exposure, chronic exposure, or acute exposure). Each of the 27 experimental groups (n = 30) underwent seizure induction and was analyzed for seizure duration and susceptibility. It was found that KD counteracts the effects of caffeine on seizure susceptibility for both chronic and acute exposure groups. Because KD and caffeine both impact seizures via manipulation of glutamate levels, these findings suggest that any glutamate inhibitor could successfully modulate caffeine. It was also found that seizure susceptibility can function as a predictor for seizure intensity. Future research should seek to investigate the pathways at play in the interaction between KD and caffeine on a cellular level.

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