CALIFORNIA SCIENCE & ENGINEERING FAIR
2018 PROJECT SUMMARY

Name(s)

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Project Number

38461

Project Title

Evidence for Variable Resistance to Caffeine in Genetically Identical Nematodes

Abstract

Objectives/Goals

Humans respond differently to the stimulatory effects of caffeine, but it is not understood why. Here we test whether chronic low-level exposure to caffeine leads to behavioral or developmental differences in the genetically identical model system, Caenorhabditis elegans, as assayed by changes in growth and movement. Since caffeine interferes with the nervous system, we hypothesized caffeine exposure could interfere with development, leading to growth arrest or even death.

Methods/Materials

Worms were grown on standard media. After 72 hours,the amount of worms and their stages were manually counted through a microscope. Worms that had reached adulthood in the experimental and control groups were separated from remaining population using a platinum wire worm pick. The movement of adult worms was measured as body bends per 20 seconds and recorded (assay) for each of two plates at 20 worms each plate. Worms that had not yet reached adulthood were allowed to develop a further 24 hours and were scored for movement and stage.

Results

After 72 hours, 100% of non-treated worms developed to young adults and remained synchronized (grew at the same rate). In contrast, the caffeine treated worms lost synchrony. After 72 hours, only about half of the population reached young adulthood, demonstrating a developmental delay.As soon as worms developed into adult worms, we tested their stimulatory response by performing a swimming assay, as a surrogate for alertness. 20 worms from each population were assayed for body bends over a 20 second interval for each of two trials. The normal- growing caffeine-treated worms had a 26% increase in their locomotion rate, thereby confirming the stimulatory effects of caffeine. In contrast, however, the slower -developing worms showed no changes in movement compared to the control- they were slower to develop but resistant to the drug.

Conclusions/Discussion

Since these are genetically identical worms, it is unlikely that in one generation they would have acquired a genetic resistance to caffeine; rather we surmise that they are showing differences due to uptake or turn-over of the drug. We conclude that it is possible for even genetically identical populations to respond differently to the chronic stimulatory effects of caffeine, as is seen in genetically diverse populations like humans.

Summary Statement

Genetically identical animal populations exhibit two distinct responses to chronic low-levels of caffeine exposure.

Help Received

All research animals,chemical, equipment and training was provided by the Maduro Lab, University of California Riverside