Dozing Off With Drosophila: The Effect of Disrupted Circadian Rhythms and Disturbed Sleep on Mortality, Mood, and Addiction

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Background: Many environmental factors can disrupt sleep and circadian rhythms, yet the consequences of such disruptions are poorly understood. The main goals of this project were to study the effects of disrupted circadian disruption and sleep on Drosophila melanogaster's: (1) lifespan, (2) depression like behaviors and (3) propensity to substance use. Methods: Circadian disruption (CD): flies with Tim01 mutation, which eliminates circadian behavioral rhythms. Sleep deprivation (SD): flies subjected to hourly light and mechanical disruption for 48 hours. Percent surviving flies over time was calculated. Impaired geotaxis or loss of climbing motivation was assessed, as a measure of depression-like state. Preference for caffeine containing food was evaluated using a choice chamber for the flies. Group differences were analyzed with survival curves. Chi-square tests were used for the categorical variables. Results: Survival curve analysis showed that Flies with the Timeless gene mutation (Tim01) have a significantly shorter lifespan than controls. Geotaxis was not significantly impaired by sleep deprivation (OR 1.89, P = 0.24), but it was negatively affected by circadian disruption (OR 3.26, P = 0.024). Both the CD (OR 26.3, P<0.001) and SD (OR 5.43, P = 0.017) groups showed a preference for caffeine containing food, after 48 hours of exposure to it, although the CD group was much more affected than the SD group. Conclusion: Sleep and circadian disturbances can negatively influence physical and mental wellbeing and the accompanying molecular mechanisms must be studied. It is critical to identify and minimize social and environmental disruptors of such biologic rhythms.

Awards Won:
Air Force Research Laboratory on behalf of the United States Air Force: Glass trophy and USAF medal for each recipient
Air Force Research Laboratory on behalf of the United States Air Force: First Award of $750 in each Regeneron ISEF Category
NC State College of Engineering: Scholarship to attend NC State Engineering Summer Camp