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EFFECTS OF A SLEEP AID MEDICATION ON FLATWORM BEHAVIOR IN SPACE FLIGHT ANALOGS

Abstract

Astronauts living in a space environment without typical Earth circadian cues have trouble sleeping and frequently use medications to help them sleep. Melatonin is one of these medications– it is endogenously produced by humans during night periods and has the advantage of a lower side effect profile compared to other pharmaceutical sleep aids. The well-characterized model organism planarians *(Girardia tigrina)* also produce melatonin, which is important in control of circadian rhythms. Additionally, planarians are amenable to ground-based experiments involving simulated microgravity and/or low magnetic field. We used planarians adapted to a 12h:12h light:dark cycle and performed data collection near the beginning of the dark cycle (14:00) when these nocturnal animals are normally active. Initial experiments were performed to determine the amount of melatonin to use throughout subsequent experiments. Melatonin was acutely administered in the planarians bathing water in concentrations ranging from 0.1 μM to 100 μM. We video-recorded the behavioral response to a negative stimulus of white light and measured distance travelled in each concentration of melatonin as compared to that travelled in the paired vehicle control containing an amount of ethanol matching that used for dilution of the water-insoluble melatonin. Pilot studies show that planarians survived doses of melatonin up to at least 100 μM with no apparent distress. Measurements made at varying concentrations of melatonin will be used to produce a concentration-response curve. The melatonin concentration at which a 50% change (EC50) in locomotory activity is seen will be determined from a fit to the Hill equation.

In subsequent experiments this concentration will be used so that both increased or decreased activity can be measured. Two analogs of the space environment are used in our laboratories. A 2 x 4 experimental design will be used with an acute dose of melatonin or vehicle control, and exposure to reduced magnetic field, Earth's magnetic field, simulated microgravity, or vibration control. The reduced magnetic field environment is produced with a μmetal shielded chamber that reduced magnetic field from 45 μTesla to about 2 μTesla. A random positioning machine is used to reduce the normal downward gravity vector (Gz) by about 2 orders of magnitude. We video-recorded behavioral response to a negative stimulus of white light, and measured distance travelled, and time spent near the light compared to time spent farther away from the light. The effects of melatonin during exposure to these space analogs will be measured.