Introduction

The relationship between food availability and nocturnal activity in mammals is well documented. Mammals that are primarily active during the dark are often referred to as "nocturnal", which means that their activity peaks during the nighttime. The concept of "nocturnal" is an oversimplification as many nocturnal species still exhibit activity during the daytime. However, nocturnal animals have evolved specific physiological mechanisms that allow them to cope with the challenges of nocturnal activity. One such mechanism is the presence of an "entrainable oscillator" (LEO) that synchronizes the circadian rhythms with the light-dark cycle. The LEO is a biological clock that regulates the timing of daily activities. The LEO is responsible for the circadian rhythms of activity, sleep, and many other physiological processes in mammals. The LEO is also sensitive to changes in the environment, such as changes in food availability. In this study, we examined the effects of lighting and food restriction paradigms on the locomotor activity of the Egyptian spiny mouse, Acomys cahirinus.

Methods

Animals and Environmental Conditions:

Ten male mice were purchased from the same supplier (Harlan Laboratories, Indianapolis, IN) and placed in the laboratory at the Plymouth State University Sciences Department. Each mouse was housed in a separate plastic cage, each equipped with a running wheel. All animals were fed IAMS Chunks dog food ad libitum. The temperature was maintained at 22°C (± 3°C) and humidity of 54% (± 10%). Three months after the initial LD entrainment period, the mice were exposed to five periods of constant light (LL; 175 lux). In order to determine if exposure to constant light (LL) can affect the LEO in A. cahirinus, a second experiment exposed male mice (n=12; six male, six female) to two periods of DD (11 and 12 days respectively) sandwiched around one period of LL (25 days, 175 lux). In a third experiment, male mice (n=12) were exposed to two sequentially increasing LL intensities (150, 300, and 400 lux). Each intensity period lasted 21, 21, 32, and 25 days respectively.

Effects of Food Restriction Paradigms:

Effects of LD, DD and LL on Activity Rhythms:

The running wheel data were collected by a computer data acquisition system (Scarpine Activity Monitor, Environmental Wardell, MA) and stored on a MicroComputex in five minute intervals. RATSIM (Kleinman et al., 1992) was used to analyze the data from these experiments. Analysis of variance (ANOVA) was used to determine if there was a significant difference in the number of wheel revolutions between treatments. The results were consistent with previous studies (Kleinman et al., 1992). This was also consistent with previous studies (Kleinman et al., 1992).

Data Analysis:

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Results

Figure 1: LD entrained rhythms persist in DD

Figure 2: LL induces “aftereffects”

Figure 3: Increasing LL → Decreasing activity

Conclusions

• Consistent with Aschoff’s “rule”, increased LL intensities resulted in decreased activity.
• LL induces “after effects” on activity rhythms.
• Results are consistent with the presence of a separate FEO in this species:
• FAA was present during periods of restricted feeding.
• Activity associated with FAA persisted in ad libitum conditions.

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