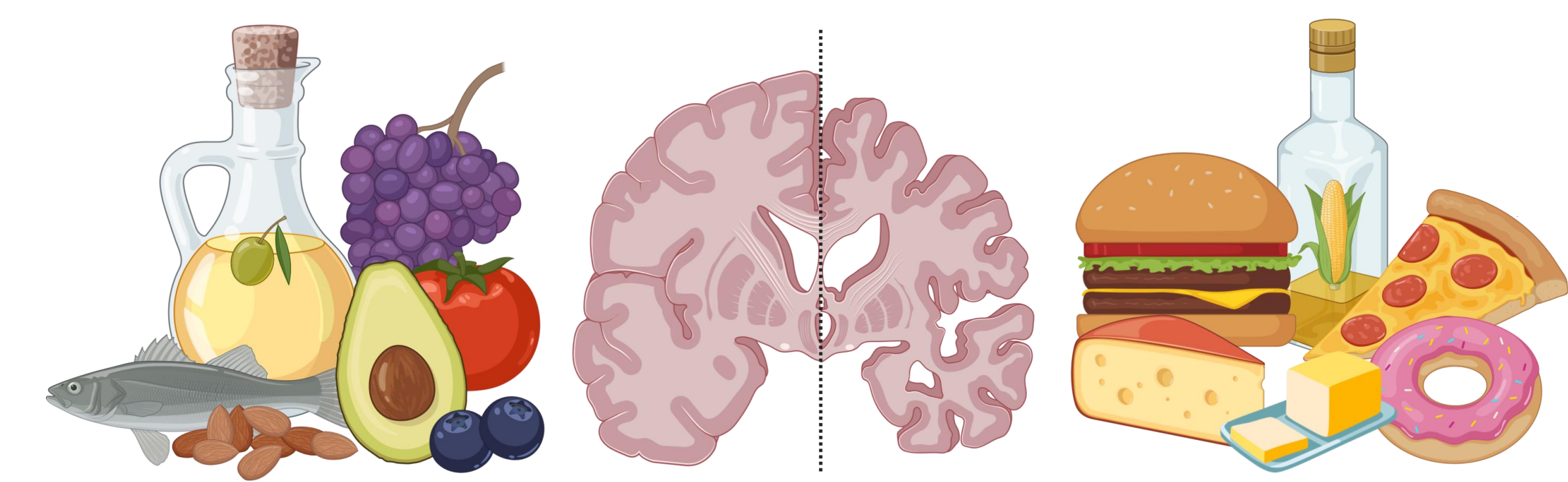


Impact of food insecurity on spatial memory capabilities and anxiety-like behavior in old-age C57BL/6J mice

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Over 6 million households with children in the U.S. suffer from food insecurity, the majority of which are insecure without hunger. Food insecurity and the accompanying chronic unpredictability are associated with significant negative physical health outcomes, such as malnutrition and impaired immune function, and psychological health outcomes, such as anxiety/eating disorders and delayed language acquisition. To better understand the connection between the unpredictability of a food source and cognitive/immunological impairments, prior studies have attempted to model food insecurity in rodent models. An ideal study design to get at this question would use a truly unpredictable food source and assess both behavioral and immunological changes in the rodents following insecurity, but most of the prior work has not been able to address all three of these features and thus are limited in the generalizability of their findings. To address these limitations, the present study aimed to ensure that the rodent's food source was truly unpredictable and that both behavioral and immunological variables were measured to draw conclusions about the true impact of insecurity. 19-month-old male and female C57BL/6J mice were either given *ad libitum* food access or were food insecure, where two nights were randomly selected during the week in which their otherwise full food-hopper would be reduced to 25% of their baseline consumption until the following morning. At 22 months, the mice underwent a battery of behavioral tests, including the open field test, elevated-zero maze, and novel object location task, to assess locomotion, anxiety-like behavior, and spatial memory capabilities. No significant differences in their behaviors were observed, suggesting that modeling food insecurity in old-age mice likely requires a more pronounced unpredictability paradigm and that the earlier developmental periods are likely more susceptible to the effects of unpredictable food access on cognition.

Methods

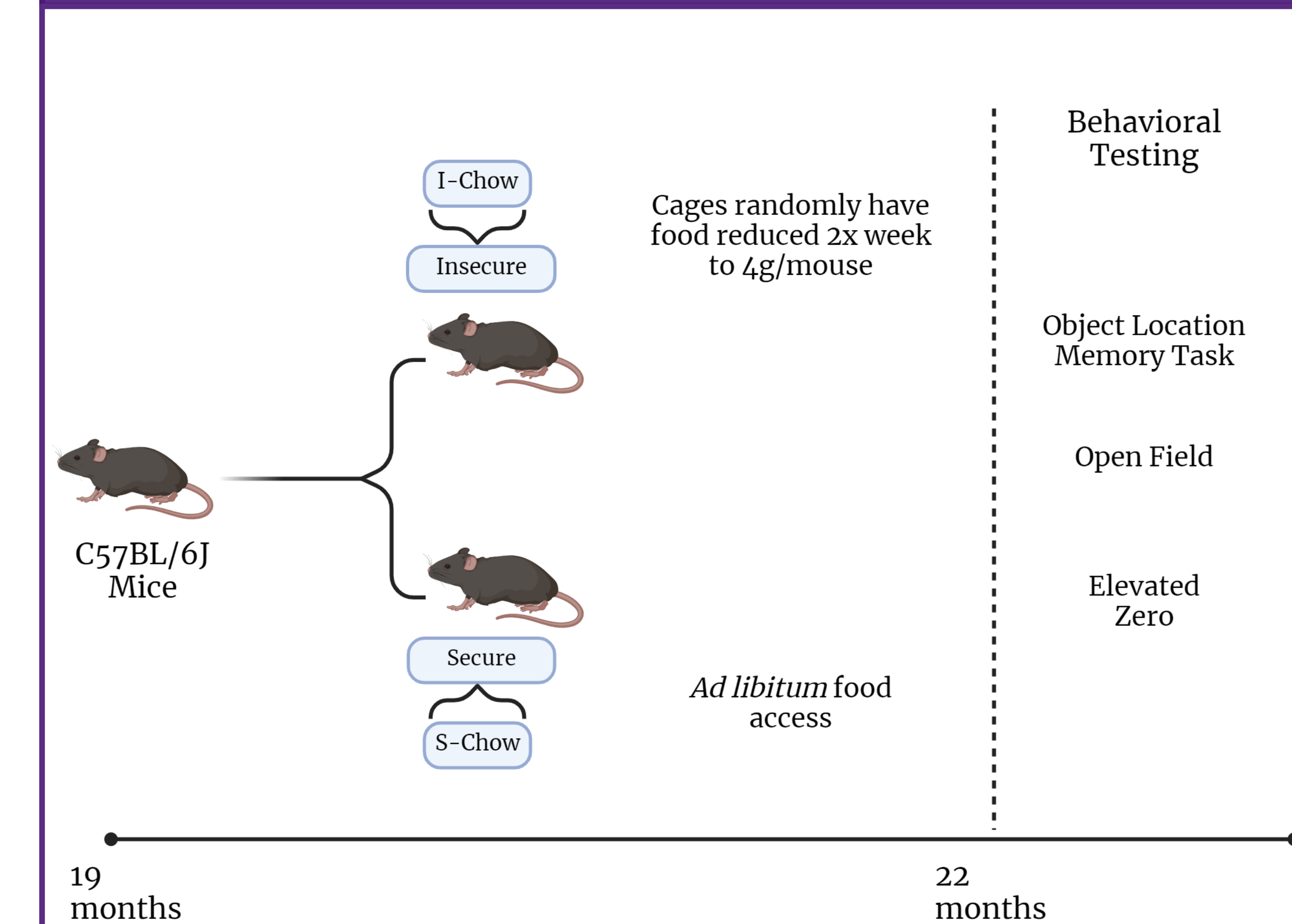
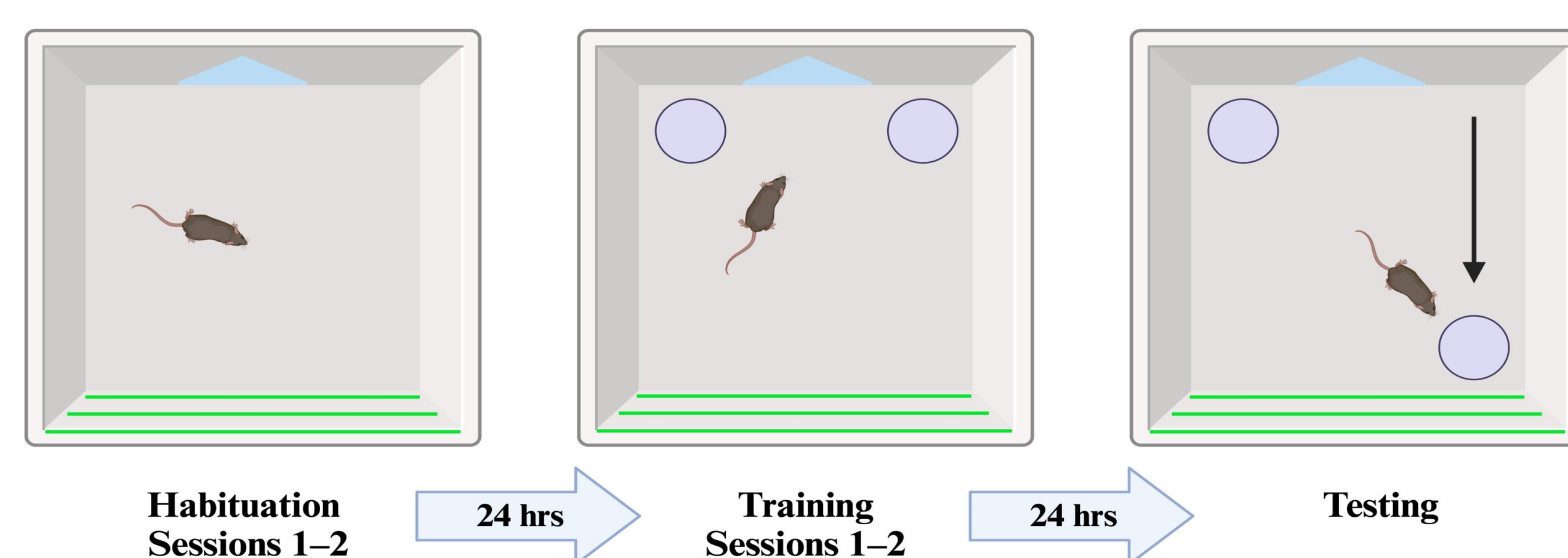
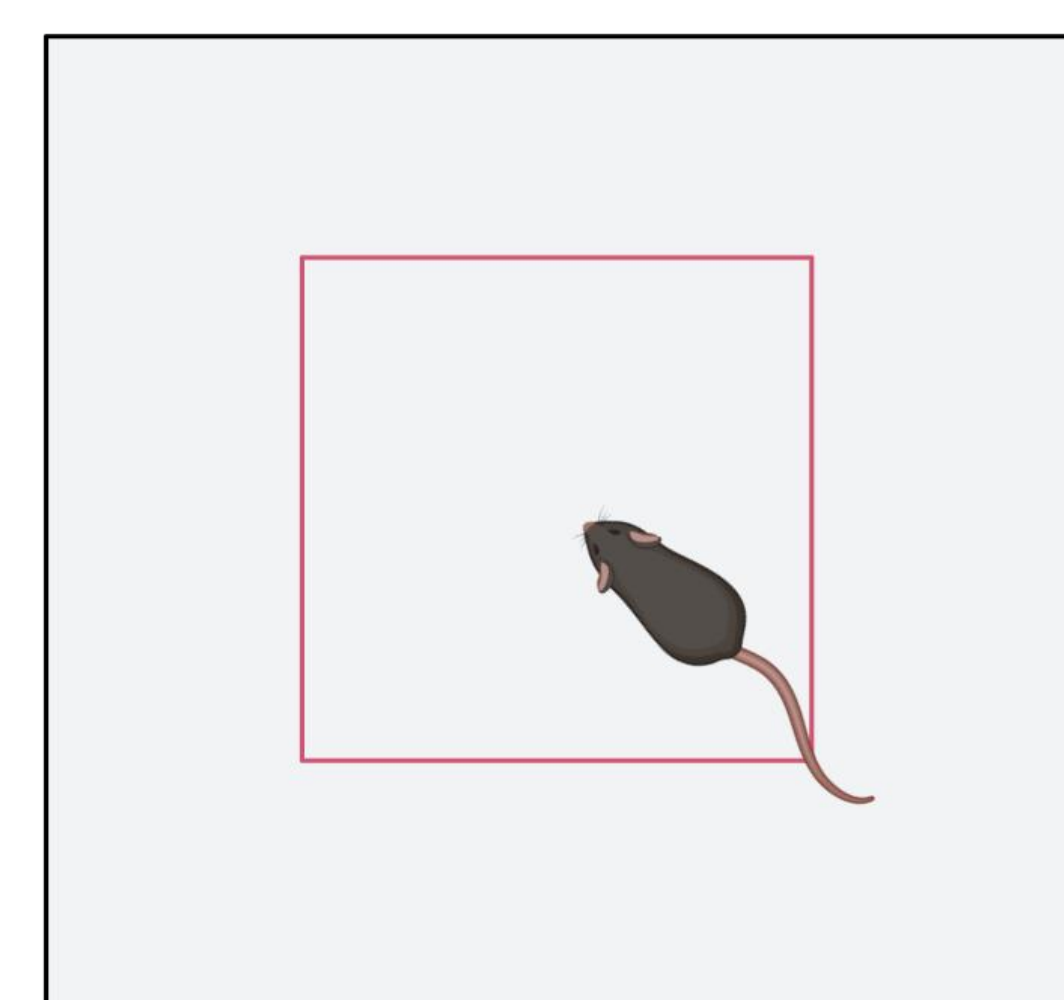


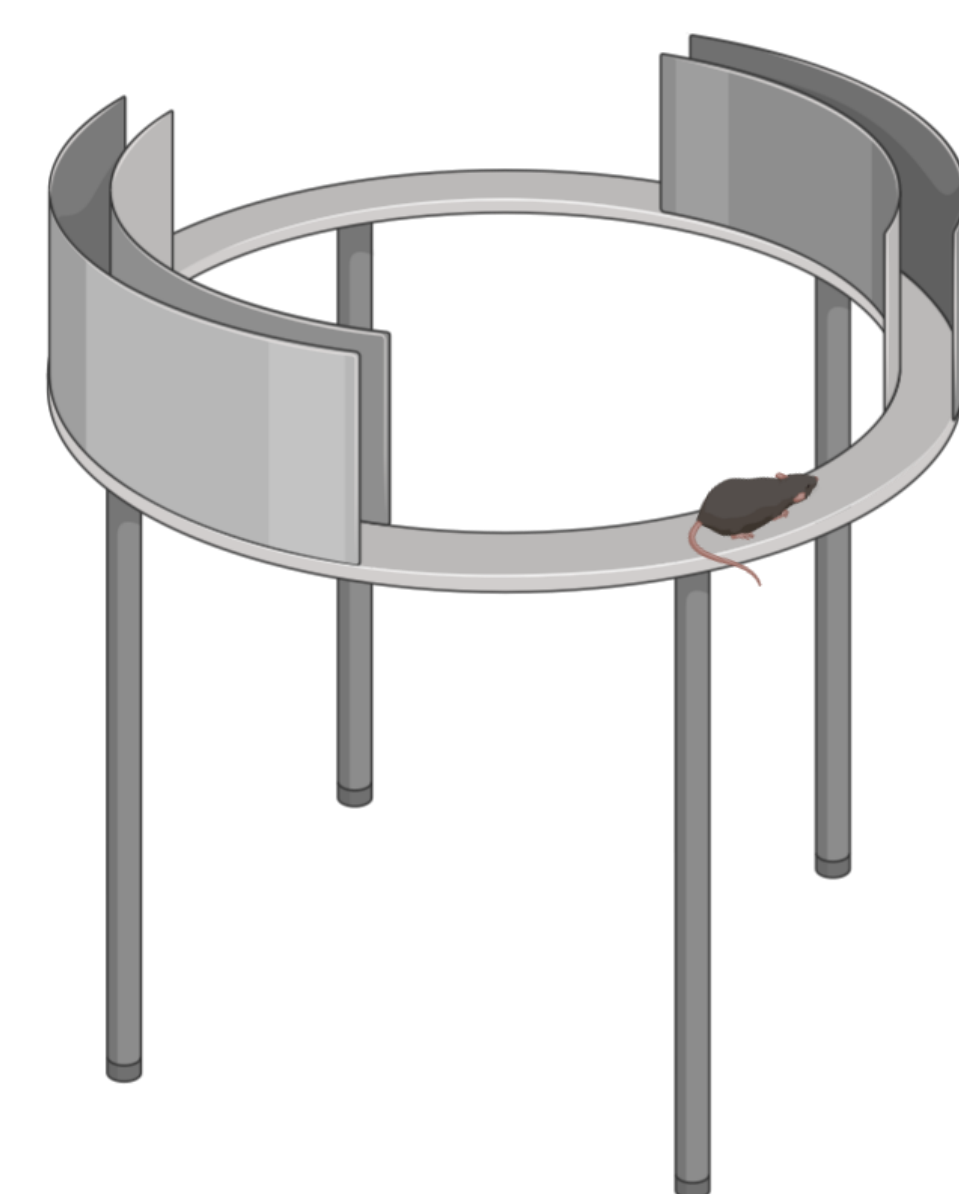
Figure 1. Experimental timeline beginning at 19 months of age.



Object Location Memory Task



Open Field Test



Elevated Zero

Figure 2. Behavior testing apparatus.

Male Behavior Results

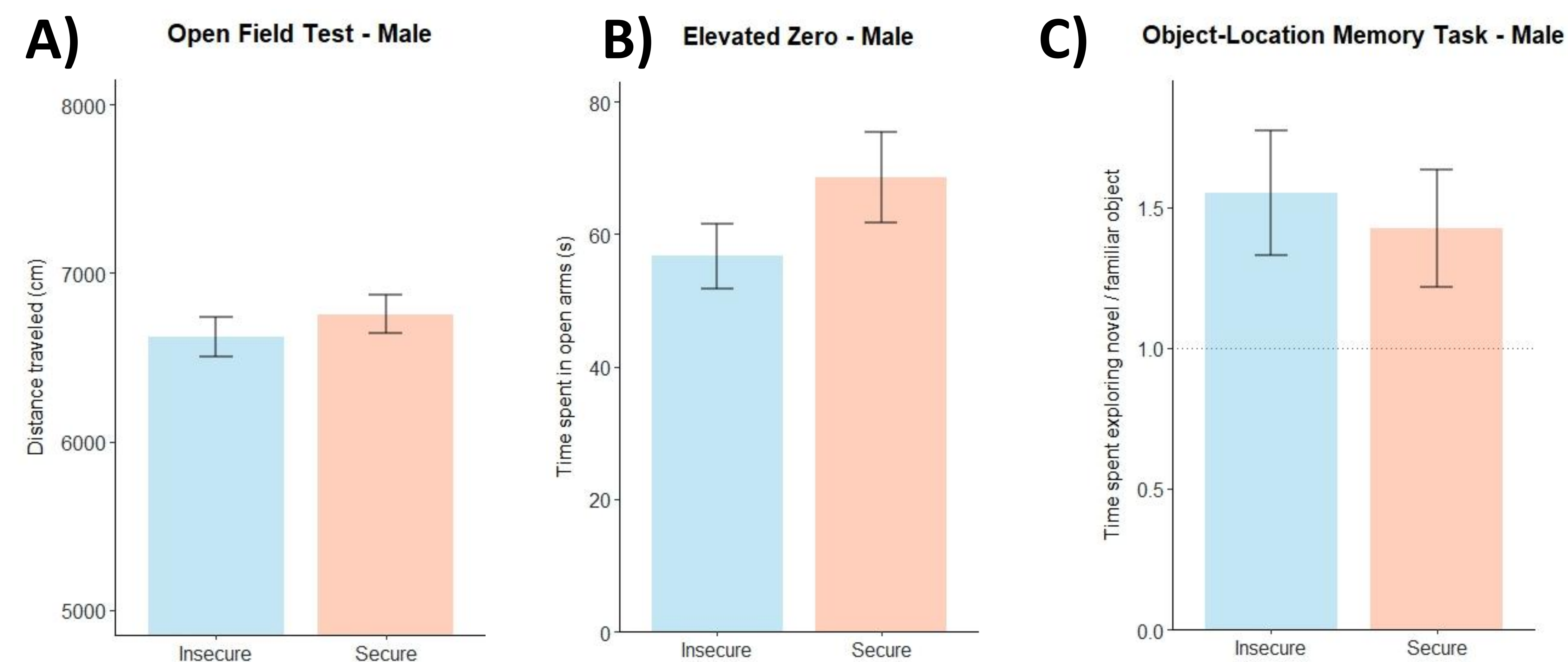


Figure 3. No effect of insecurity on anxiety-like behavior, locomotion, and spatial memory in male mice. Unpaired t-tests revealed no significant difference in (A) locomotion, (B) anxiety-like behavior and (C) spatial memory between insecurity conditions, $ps \leq 0.11$.

Female Behavior Results

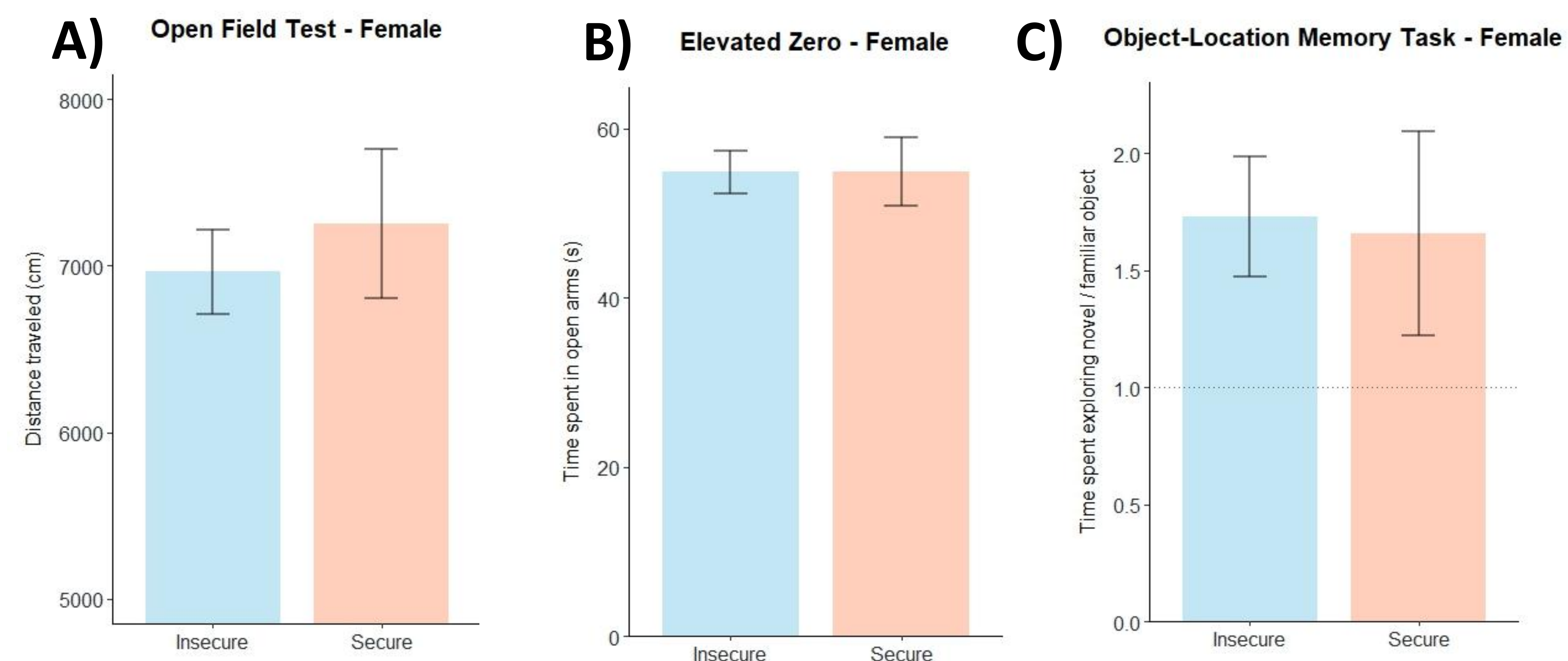


Figure 4. No effect of insecurity on anxiety-like behavior and spatial memory in female mice. Unpaired t-tests revealed no significant difference in (A) locomotion, (B) anxiety-like behavior and (C) spatial memory between insecurity conditions, $ps \leq 0.14$.

Conclusions

- There were no significant differences in cognition and memory following three months of unpredictable food access in both male and female old-age mice.
- Results suggest that either the insecurity paradigm is not sufficiently unpredictable or that the effects of unpredictable food access are not significantly pronounced when exposed only during old-age.

Future Directions

- Investigate unpredictable food access in younger age groups to confirm if the present findings are due to the age of the mice or the insecurity paradigm.
- Determine how the predictability of a food source may interact with the food's quality by adding groups of mice exposed to high-fat diets or representative Western-style diets
- Analyze serum and brain tissue expression of inflammation-related genes with rt-PCR and proteins with electrochemiluminescence

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