

# Discounting of Delayed Food and Water in Rats

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## Introduction

### Delay Discounting:

- Reduction in the value of outcomes as a function of their delay.
  - e.g., \$100 now is more preferable over \$100 in a year.
- Measuring the degree of delay discounting involves assessing preferences between outcomes that vary in amount and delay
  - e.g., one food pellet now vs. three food pellets in thirty seconds.
- Strong preferences for immediate outcomes are associated with problem behaviors such as cigarette smoking (Friedel et al., 2014; Mitchell, 1999).

### Goals:

- Examine if rats discount qualitatively different outcomes similarly.
- Examine delay discounting in rats across time, early to mid-adulthood, to assess test-retest reliability as well as to track changes that occur over time.
- Examine if discounting has trait-like characteristics of test-retest reliability and response consistency, in terms of how correlated discounting of food is with discounting of water.

### Benefits of using non-human subjects:

- Eliminates the tendency to respond in a manner that will be viewed by others as favorable (social desirability).

## Methods

### Subjects:

- Twenty-eight male Long Evans rats:
- Pair housed with a 12 hour light/dark cycle

### Apparatus:

- 4 Coulbourn operant chambers were used
- Each chamber had a house light and two retractable levers
- Between each lever was a liquid dripper/ pellet trough

### Procedure:

- Smaller-sooner reward (SSR): 1 food pellet or 1 0.1 mL dipper of water
- Larger-later reward (LLR): 4 food pellets or 4 0.1 mL dippers of water
- Adjusting Delay (Mazur, 1987; Wahab, Panlilio, & Solinas, 2018)
- Outcome type altered every other session (e.g., food-water-food-water)

## Procedure continued

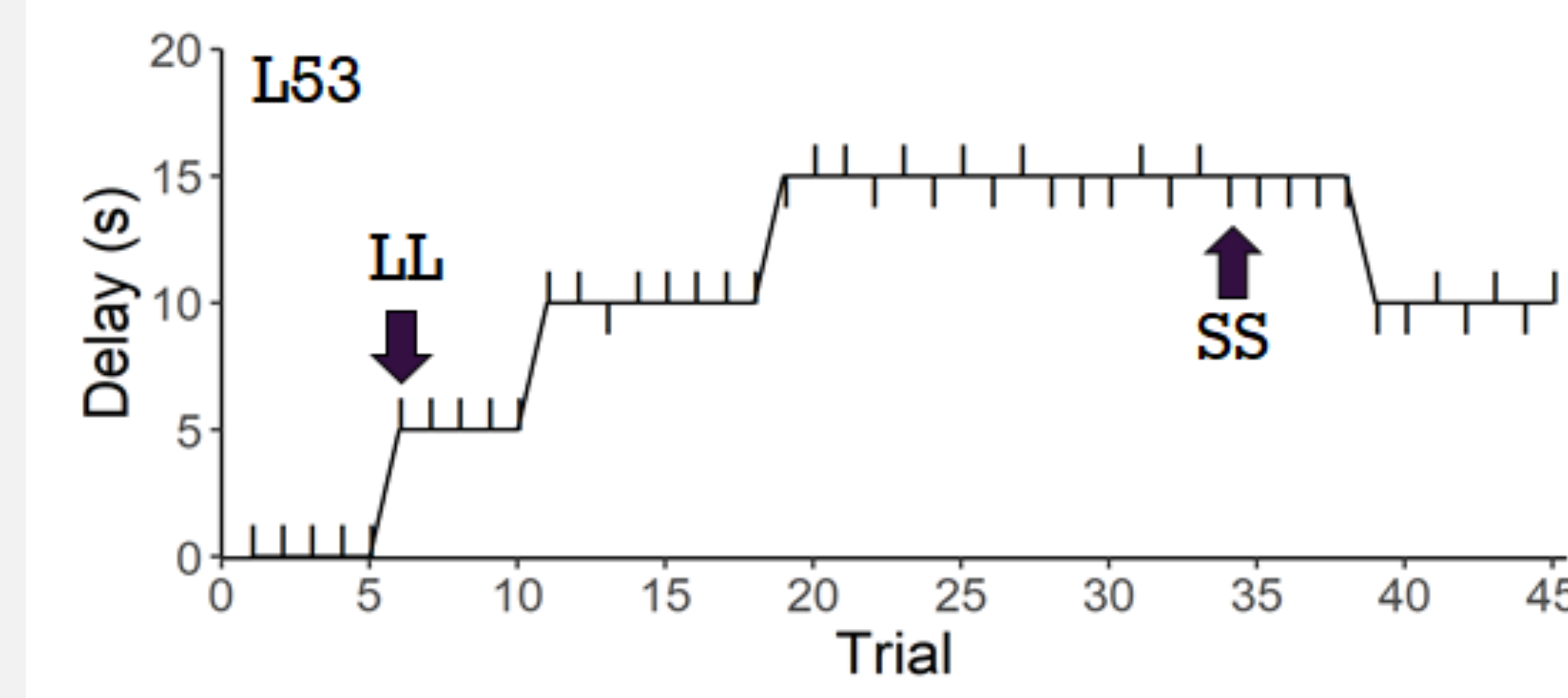


Figure 1. Data from a single subject, L53, depicting the contingency in which rats' choices during a session adjusted the delay to longer later reward. The x-axis is trial and the y-axis is the current delay time in seconds. Up-ticks represent a choice for the larger later reward and down-ticks represent a choice for the smaller sooner reward. Every five consecutive responses for the larger-later reward resulted in a five second delay increase whereas every five consecutive responses for the smaller sooner reward resulted in a five second delay decrease. Switching between responses for the smaller sooner reward and larger later reward resulted in no adjustment.

### Dependent Variable: Mean-adjusted delay (MAD)

- Average delay to larger-later reward
  - $D_i$  = delay to LLR on the  $i^{\text{th}}$  trial
  - $n$  = number of trials within session (45)
- Higher MAD correspond to more choices for the LLR.
- Smaller MAD correspond to more choices for the SSR.

$$\frac{\sum_{i=1}^n (D_i)}{n}$$

## Results

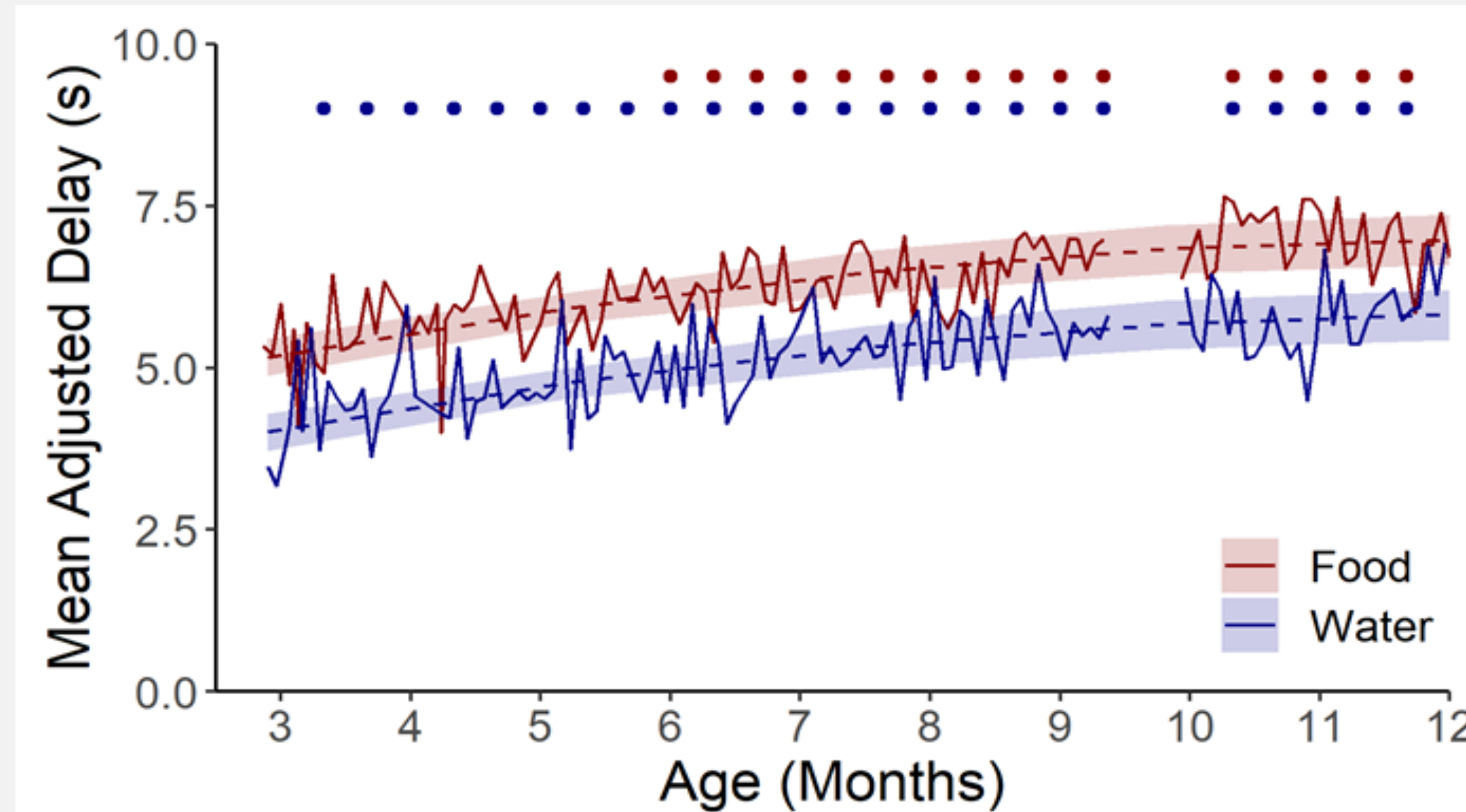


Figure 2. Mean adjusted delay (MAD) as a function of age, averaged across subjects, separately for food and water. The trend lines are from a regression model indicating that as they aged, MAD increased, indicating a decrease in discounting. The error bands indicate 95% confidence intervals around the trend lines. Datapoints at top of figure indicate blocks of sessions that were significantly correlated with the final block of sessions.

## Results Continued

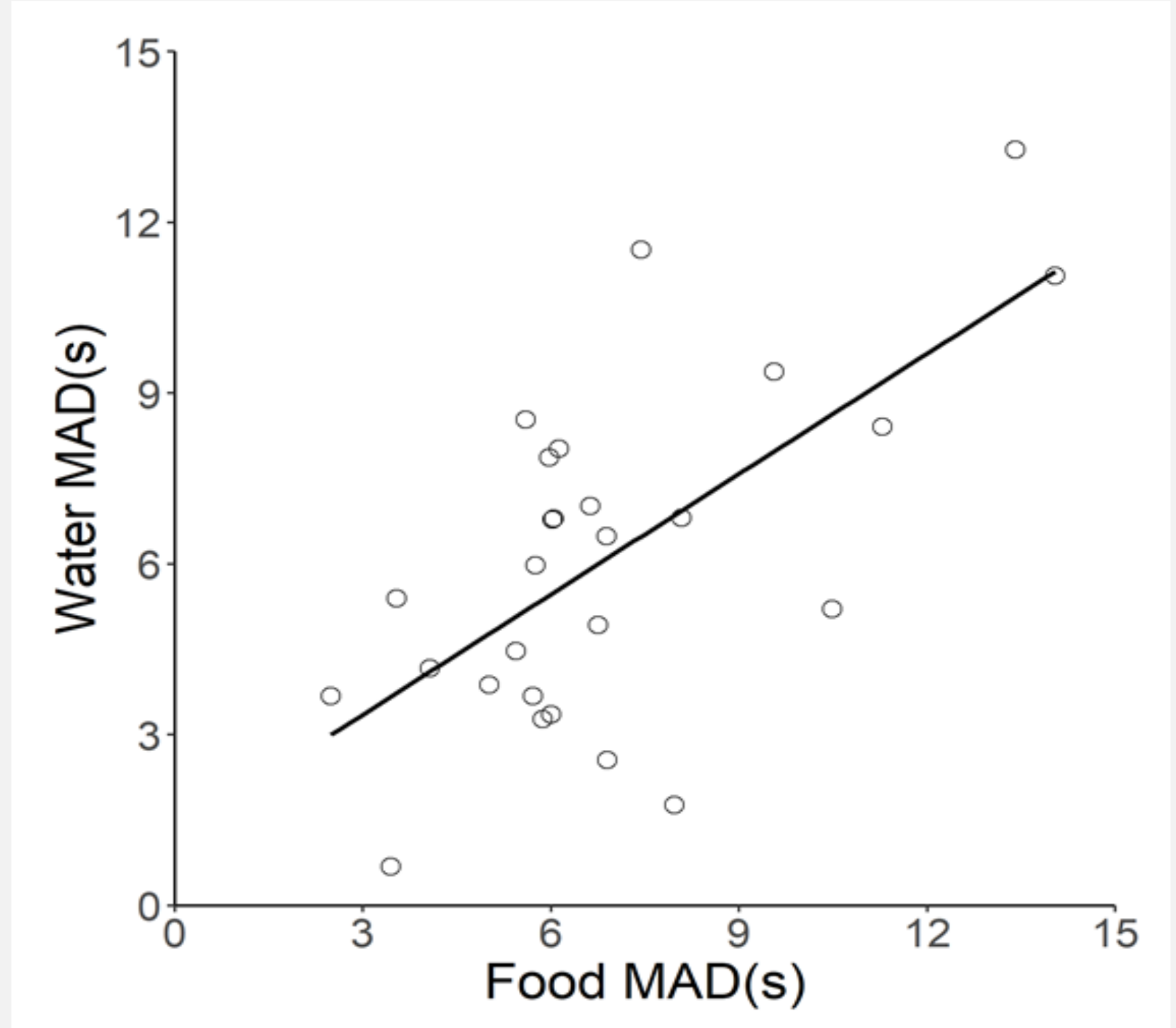


Figure 3. This figure shows MAD for water as a function of MAD for food in the final block of sessions. Discounting for water is associated with discounting for food.

## Conclusions

- Overall, we found that discounting decreased over time, demonstrated by an increase in MAD over time (Figure 2).
- We found that discounting for food is correlated with discounting for water (Figure 3).
- We found evidence of trait-like characteristics of discounting (Figures 2 & 3).

## References

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