



# Girls Just Want to LL: An Investigation of a Fixed Interval Intervention Effect on Impulsive Choice Between Sexes

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## INTRODUCTION

- Impulsive choice refers to choosing a smaller, sooner reward (SS) over a larger, later reward (LL).
- Impulsive individuals discount a reward's value at a much steeper rate, which is associated with ADHD and substance abuse in humans.<sup>1,2,3,4</sup>
- Sex difference in delay discounting are not well studied, but there are differences in substance abuse patterns.<sup>5</sup>
- Men are more likely to become dependent, but women progress from initiation to dependence more quickly.<sup>5</sup>
- Given the relationship between impulsive choice and drug abuse<sup>1</sup>, time-based interventions have been developed to moderate impulsive choices.
- A fixed-interval (FI) intervention decreased impulsive choices in male and female rats separately.<sup>6,7</sup>
- This study directly compared male and female rats' impulsive choice behavior and FI intervention efficacy.
- Hypotheses:
  - The FI intervention should promote greater LL choices compared to the control condition.
  - The intervention should increase LL choices for both male and female rats.

## METHODS

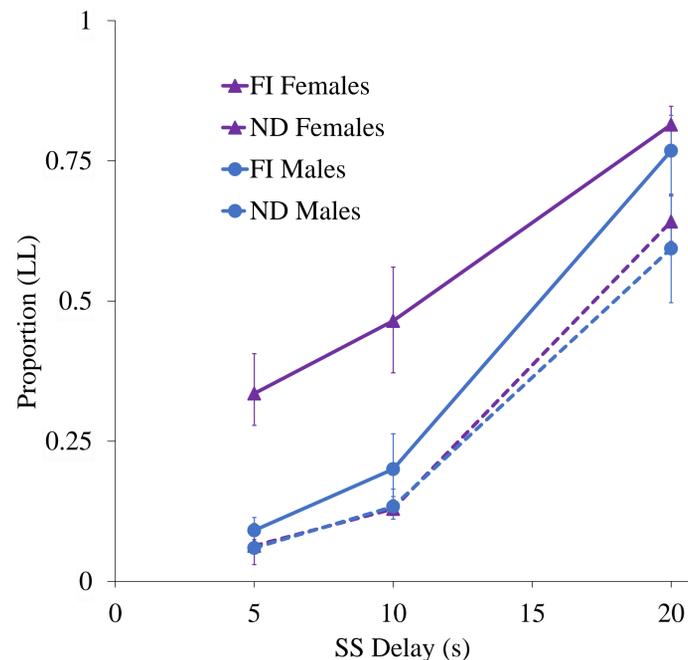
- **Animals**
  - 24 male and 24 female experimentally-naïve Sprague-Dawley rats were used.
  - Three male rats were removed due to health issues.
- Male and female rats were randomly assigned into two groups; fixed-interval (FI) or no delay (ND).
  - FI Females (n=12)      ND Females (n=12)
  - FI Males (n=10)      ND Males (n=11)
- **Intervention**
  - FI: SS (1 p, 10 s); LL (2 p, 30 s)
  - ND: SS (1 p, 0 s); LL (2 p, 0 s)
- **Impulsive Choice Task**
  - Phase 1: SS (1 p, 5 s); LL (2 p, 30 s)
  - Phase 2: SS (1 p, 10 s); LL (2 p, 30 s)
  - Phase 3: SS (1 p, 20 s); LL (2 p, 30 s)

s = seconds  
p = pellet(s)

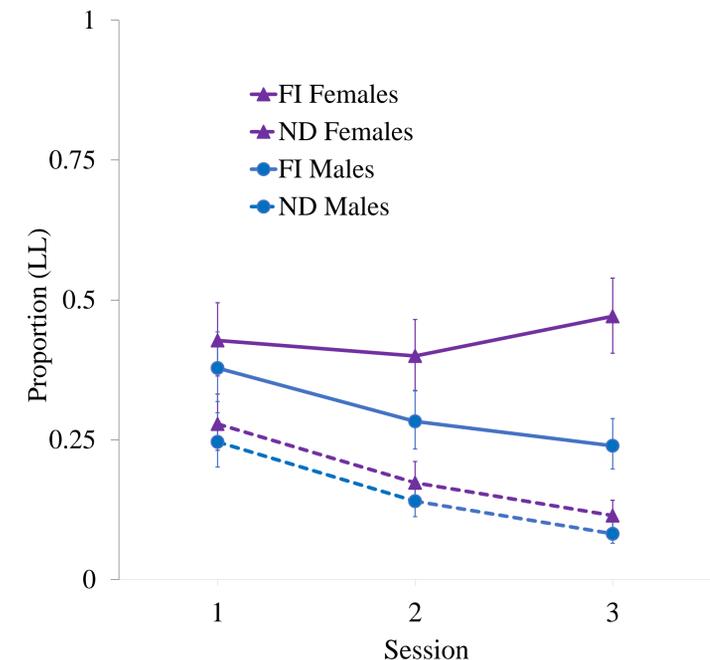


- **Data Analysis**
  - The last five sessions of each phase of the choice task were analyzed using a multilevel mixed-effects regression model with an intercept at a zero delay.
  - Choices at the intercept provided an index of the bias for immediacy.
  - The slope of the regression function provided an index of sensitivity to delay.

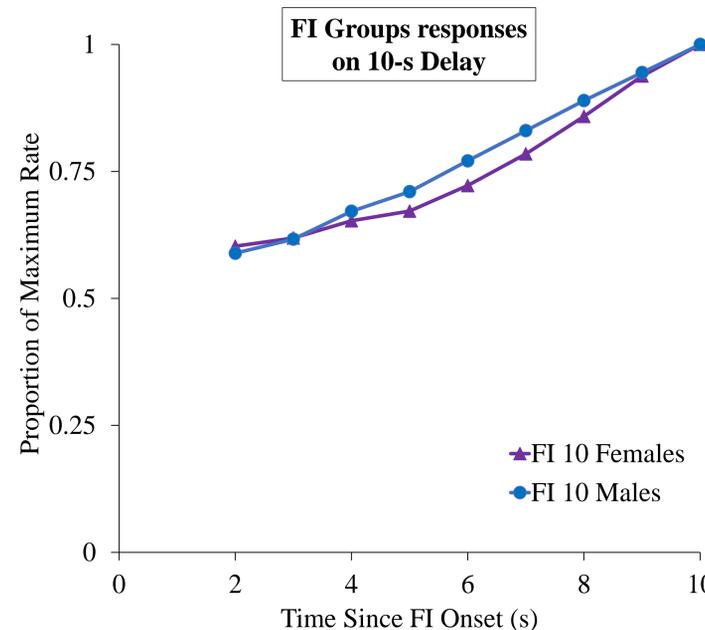
## RESULTS



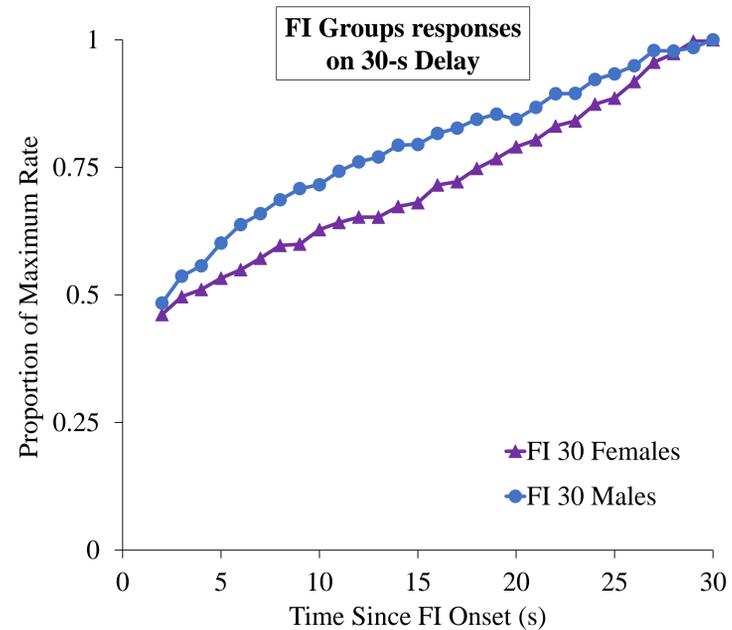
**Figure 1. Proportion of LL choices across SS Delay.** The FI females made more LL choices displaying a decreased preference for immediacy at the smaller delays. Sex differences diminished as a function of SS Delay suggesting both sexes preferred larger rewards. The FI females displayed decreased sensitivity to delay compared to the FI males. The ND groups didn't differ in choice between sexes.



**Figure 2. Proportion of LL choices over first three sessions of the 5-s SS Delay.** The FI groups exhibited a nearly two-fold increase in LL proportion compared to controls during session 1. The FI males then displayed the emergence of an increased SS preference. The ND males and females showed stronger SS preference and did not differ from each other.



**Figure 3. Response rate during 10-s fixed-interval intervention.** There was no difference in the response rate functions between sexes during the 10-s FI intervention. This suggests they timed this delay similarly during the intervention.



**Figure 4. Response rate during 30-s fixed-interval intervention.** Females displayed a steeper increase in response rates over the FI 30-s schedule, suggesting they were timing the 30-s delay more precisely than the males.

## DISCUSSION

- The FI intervention increased LL choices compared to the ND control, regardless of sex, but females showed a larger effect of the intervention.
- At the 5-s delay, FI females displayed a resistance to developing an SS preference.
- The FI females timed the 30-s delay more precisely providing a potential explanation for the increased efficacy of the FI intervention.
- The sex differences in the intervention efficacy may have stemmed from differences in timing processes for males and females.
- However, the strong SS preference in the FI males in this study is unusual compared to previous research conducted in our lab.<sup>6</sup>
- Further studies should elucidate the differences between sexes and their resistance to temptation of an immediate reward.

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